54413

ADDENDUM TO THE FINAL FEASIBILITY STUDY REPORT
NL INDUSTRIES, INC. SUPERFUND SITE
OPERABLE UNIT ONE
PEDRICKTOWN, NEW JERSEY

Introduction

The U.S. Environmental Protection Agency (EPA) has prepared this addendum to the Feasibility Study (FS) Report for the NL Industries, Inc. (NL) Superfund Site located in Pedricktown, New Jersey. The FS Report was prepared by O'Brien & Gere Engineers, Inc. (OBG) for NL, a Potentially Responsible Party for the site.

This addendum report serves as a companion document to NL's May 1993 FS Report for Operable Unit One. This document addresses several issues which EPA has determined need further discussion and/or clarification. It further corrects errors and discrepancies within the FS Report. In addition, this Addendum documents conclusions arrived at by EPA through review of the FS Report, site related data and other information, which have not been reached by NL. The issues mentioned above are discussed in the following paragraphs.

GENERAL ITEM:

Based upon the results of the Remedial Investigation (RI), EPA believes that contamination in stream sediments extends from the on-site portions of the West and East Streams and the drainage channel north of Route 130, to the Delaware River. This is evidenced by the generally decreasing contaminant gradient toward the Delaware River.

SPECIFIC MODIFICATIONS:

EXECUTIVE SUMMARY

Pg. ES-2 Remedial Investigation/Supplemental Investigations

Sediments: It should be noted that the Federal Ambient Water Quality Criteria (AWQC) (approximately 3.2 parts per billion (ppb) for lead) for the protection of aquatic life for lead was exceeded in the surface water for all sections of the stream and drainage channel. This is evident in sampling results shown in Table 3 of the FS Report.

Pgs. ES-3 Remedial Action Objectives

Throughout the FS Report, note that the remedial action objective for lead in ground water is 10 ppb. This is the Practical Quantitative Limit (PQL) for lead

established by the New Jersey Department of Environmental Protection and Energy (NJDEPE). Note that the New Jersey Ground Water Quality Standard (N.J.A.C. 7:9-6) for lead is 5 ppb. A PQL is the lowest concentration that can be reliably detected by a laboratory during routine laboratory operating conditions.

Pgs. ES 4-14

Several of the soil alternatives, as well as the sediment alternatives, have been modified to provide appropriate consistency between alternatives, incorporate EPA's preference for treatment, and reflect what EPA believes to be accurate cost estimates for alternative components. In addition, EPA has modified all soil alternatives to include treatment and disposal of excavated stream sediments with the site soils. Hence, sediment alternatives no longer include treatment and off-site disposal as expressed in the FS Report.

EPA is expecting to undertake Phase V of its Removal Action during the summer and fall of 1993. This phase of the Removal Action will involve the removal of the most highly contaminated stream sediments from the West Stream and eliminate them as a source of contamination to the environment. Excavated material will likely be disposed of off site. Upon completion of EPA's action, the Salem County Mosquito Commission (SCMC) may take further action to deepen and widen the stream in order to allow drainage of areas that lie upland of the site. The Removal Action is expected to be consistent with the long term remedial action at the site.

Since EPA will shortly be undertaking Phase V of its Removal Action to remove contaminated sediments from the West Stream, the two sediment alternatives, No Action, and Sediment Excavation will address sediments in the East Stream and the drainage channel north of Route 130 only.

The FS Report is modified throughout regarding contaminated soils and sediment at the site as follows: If a material fails Toxicity Characteristic Leachability Procedure (TCLP) testing, then it is characterized as a hazardous waste and is subject to Resource Conservation Recovery Act (RCRA) regulation. RCRA regulation requires treatment prior to disposal of such wastes. Although there is an exemption from treatment for lead contaminated soils which fail the TCLP test, but pass the EP Toxicity test (Land Disposal Restrictions, 55 CFR 106), which may be applicable to portions of the hazardous soils at the NL site, EPA requires that all site soils which are determined to be hazardous wastes be treated prior to disposal. This is consistent with the Comprehensive Environmental Response, Compensation and

Liability Act's (CERCLA's) statutory preference for treatment, especially since RCRA regulations require treatment for a large portion of the site soils in any event. However, for soil Alternative G, which includes removal of all soil above the remedial action objective from the site, EPA will not require treatment of the exempted soils. The soil alternatives in the FS Report did not require treatment of all hazardous soils.

Soil Alternative H, and all references to it, are hereby deleted throughout the FS Report. Based upon human health and ecological risks at the site, this alternative, which utilizes two different cleanup values, is not justified, nor is it approved, by EPA.

The term "Months to Achieve Remedial Action Objectives" refers to the amount of time it would take to design, construct and complete the action. "N/A" implies that the "Months to Achieve Remedial Action Objectives" is not applicable for the particular alternative. "O&M Cost" refers to the cost of operation and maintenance during implementation of the particular alternative.

All costs presented below are for cleanup of soils and sediments to 500 ppm of lead. After incorporating the above referenced changes, the soil and sediment alternatives described in the FS Report are hereby modified throughout the FS Report as follows. A detailed breakdown of the costs and volumes of soil for the modified alternatives may be found in the attached Attachment A to this Addendum.

Soils Alternatives

Soil-A: No Action / Institutional Control

Capital Cost:	$149,000
Annual O&M Costs:	$2,000
Present Worth Cost:	179,800
Months to Achieve Remedial Action Objective:	3

Superfund regulations require that a No Action alternative be evaluated at every site to establish a baseline for comparison with other alternatives. The No Action alternative for soils not meeting remedial action objectives would include institutional controls and site access restrictions, such as fencing and deed restrictions. In addition, assessments would be performed every five years to determine the need for further actions.

Soil-B: Excavate All Soils above the Remedial Action Objective / Treat All Excavated Soils Using Soil Washing / Backfill of Treated Soils Meeting the Remedial Action Objective

Capital Cost:	$22,084,700
Annual O&M Costs:	$5,000
Present Worth Cost:	$22,161,700

Months to Achieve Remedial Action Objective: 42

All soils, including soils in wetland areas, not meeting the remedial action objective would be excavated and treated (along with stream sediments) using soil washing. The soil washing technology may utilize both physical size separation and chemical separation to remove contaminants from the soil. Liquid washing fluids would be recycled into the process and later disposed of off site along with extracted contaminants. Washed soil meeting the remedial action objective would be returned to the excavated areas. Washed soil rendered non-hazardous, but not meeting the remedial action objective would be placed in a landfill to be constructed on site. Secondary wastes from the soil washing process, including fines, would be treated on site and disposed of off-site at an appropriate RCRA-permitted facility. Treatability studies would be required to determine the efficiency of the soil washing system, and to the determine the optimum operating parameters for the soil washing system. The treated material would require TCLP testing to confirm that the material is non-hazardous prior to returning it to the site.

Soil-C: Excavate All Soils above the Remedial Action Objective / Treat All Excavated Soils Using Solidification / Stabilization / Landfill Treated Material On Site

Capital Cost:	$13,306,400
Annual O&M Costs:	$5,000
Present Worth Cost:	$13,383,400

Months to Achieve Remedial Action Objective: 24

All soils not meeting the remedial action objective would be excavated, treated on site by solidification/stabilization (S/S) (along with stream sediments), and landfilled on site. This technology immobilizes contaminants by binding them into an insoluble matrix. Stabilizing agents such as cement, pozzolan, silicates and/or proprietary polymers would be mixed with the feed material. The equipment is similar to that used for cement mixing and handling. Bench-scale tests would be required to select the proper ratio of stabilizing agents, feed material, and water. Depending on the specific treatment process, the volume of stabilized material may increase by up to 50 percent of the original volume. The treated material would require TCLP testing to confirm that the material is non-hazardous. Excess treated material which can not be landfilled on site due to space limitations would be transported and disposed of in a RCRA-permitted facility.

Soil-D: Excavate All Soils above the Remedial Action Objective / Soil Wash Hazardous Soils / Landfill Non-Hazardous Soils On Site / Backfill Treated Soil Meeting Remedial Action Objectives

Capital Cost:	$10,635,500
Annual O&M Costs:	$5,000
Present Worth Cost:	$10,712,500

Months to Achieve Remedial Action Objective: 36

All soils not meeting the remedial action objective would be excavated. Excavated soils (along with stream sediments) which are non-hazardous would be landfilled on site. Excavated soils and sediments which are classified as hazardous waste would be treated using soil washing as described under Alternative B, above. Washed soils meeting the remedial action objective would be returned into excavated areas. Washed, non-hazardous soils that do not meet the remedial action objective would be landfilled on site along with the excavated non-hazardous soils. Secondary wastes, such as fines, from the soil washing process would be treated and disposed of off-site at an appropriate RCRA-permitted facility.

The on-site landfill to be constructed to contain non-hazardous soils contaminated above the remedial action objective would include a liner underlying the landfill as well as a geomembrane cap. The base of the landfill would be built up with clean fill to raise the level above the 100-year flood plain. Six inches of gravel would be placed over the geomembrane cover as a drainage layer. Approximately 30 inches of soil would be placed and seeded over the drainage layer.

Soil-E: Excavate All Soils above the Remedial Action Objective / Landfill Non-Hazardous Soils On Site / Solidification/Stabilization of Hazardous Soils / Dispose Treated Soil Off Site

Capital Cost:	$10,344,900
Annual O&M Costs:	$5,000
Present Worth Cost:	$10,421,900

Months to Achieve Remedial Action Objective: 24

Under this alternative, soils not meeting the remedial action objective would be excavated. Excavated soils (along with stream sediments) which are non-hazardous would be landfilled on site. The landfill would be constructed as described in soil Alternative D. Excavated soils (along with stream sediments) which are classified as hazardous would be treated on site using S/S as described in Alternative C. The solidified/stabilized soils would then be disposed of off-site at an appropriate RCRA-permitted facility.

Soil-F: Excavate All Soils Above the Remedial Action Objective / Solidification / Stabilization of Hazardous Soils / Landfill Treated and Non-Hazardous Soils On-Site

Capital Cost:	$6,403,350
Annual O&M Costs:	$5,000
Present Worth Cost:	$6,480,350

Months to Achieve Remedial Action Objective: 24

Under this alternative, soils not meeting the remedial action objective would be excavated. Excavated soils (along with stream sediments) which are non-hazardous would be landfilled on site. The landfill would be constructed as described in soil Alternative D. Excavated soils (along with stream sediments) which are classified as hazardous would be treated on site using S/S as described in Alternative C. The solidified/stabilized soils would then be landfilled on site along with the excavated non-hazardous soil.

Soil-G: Excavate All Soils above the Remedial Action Objective/Dispose Off-Site

Capital Cost:	$15,840,200
Annual O&M Costs:	N/A
Present Worth Cost:	$15,840,200

Months to Achieve Remedial Action Objective: 24

All soils not meeting the remedial action objective would be excavated. Based on sampling, hazardous and non-hazardous soils would be segregated. All soil (along with stream sediments) would be transported off site to an appropriate, permitted facility for treatment and disposal based on soil characteristics.

Sediments

Sediments-A: No Action

Capital Cost:	N/A
Annual O&M Costs:	$13,580
Present Worth Cost:	$209,000

Months to Achieve Remedial Action Objective: 3

Superfund regulations require that a No Action alternative be evaluated at every site to establish a baseline for comparison with other alternatives. The No Action alternative for sediments not meeting the remedial action objective would include institutional controls and access restrictions, along with monitoring of surface water quality in the East and West Streams and drainage channel north of Route 130. In addition, assessments would be performed every five years to determine the need for further actions.

Sediments-B: Sediment Excavation

Capital Cost:	$2,148,200
Annual O&M Costs:	N/A
Present Worth Cost:	$2,148,000

Months to Achieve Remedial Action Objective: 18

Sediments not meeting the remedial action objective in the East Stream and drainage channel north of Route 130 to the Delaware River would be excavated. Sediments would be managed, to the extent practicable, in accordance with the selected soil alternative. Remediation of the stream and drainage channel would be accomplished by excavation and dredging. Most of the dredging could be accomplished from access adjacent to the streams and channel. However, some of the dredging in wide areas of the stream may require a barge mounted excavation device. Sediments would need to be de-watered prior to handling for treatment and disposal with soils. It is estimated that up to 7,900 cubic yards of sediments would be remediated under this alternative.

<u>Ground Water</u>

The costs described in Ground Water Alternatives tables (Tables 19-27) in the FS Report have not been modified. However, Ground Water Alternative-G has been divided into two sub-alternatives, which have been elaborated on below.

Ground Water-G: Pump and Treat with Direct Discharge to Surface Water

	Stream	Delaware
Capital Cost:	$3,741,000	$3,525,000
Annual O&M Costs:	$510,785	$427,245
Total Present Worth Cost:	$11,529,000	$10,093,000

Months to Construct Remedy: 36-54

Under Alternative G, two sub-alternatives (G-1 and G-2) were developed. The FS Report describes both alternatives, however, not in great detail. Both of these alternatives would consist of pumping and treating contaminated ground water on site from the unconfined aquifer and discharging the treated ground water to a surface water body. The ground water extraction and treatment process would be similar to that described for Alternative B.

G-1: Surface Water Discharge to the East or West Stream: Lead discharge standards to these surface water bodies are expected to be lower than the remedial action objective for lead in the ground water of 10 ppb. The discharge criteria for lead would be the Ambient Water Quality Criteria, which is estimated to be 3.2 ppb. For discharge to either the East or West Streams, a discharge standard of 500 ppm for TDS would apply. Treated ground water would be discharged to the East or West Stream through a discharge pipe.

G-2: Surface Water Discharge to the Delaware River: The Delaware River is located approximately 1.5 miles to the northwest of the site. Since discharge to the Delaware River would constitute an off-site discharge, a New Jersey Pollution Discharge Elimination System (NJPDES) permit would be required. The NJDEPE would develop surface water discharge numbers under its permitting authority. Based on a preliminary analysis, it is not expected that reverse osmosis treatment would be required to meet requirements for TDS under the terms of the NJPDES permit. With the exception of not requiring a reverse osmosis unit, the treatment system described in Alternative B is expected to meet discharge criteria to be established by NJDEPE for discharge to the Delaware River. For this option, treated groundwater would be transported via a 1 1/2 mile pipeline from the treatment plant located on-site to the Delaware River. Appropriate access agreements and permits for the construction of the pipeline would be obtained.

SECTION 1 - INTRODUCTION

Pg. 5 Last Sentence. Appendix N - Soil and Sediment Volume Calculations do not exist and should not be referenced.

Pg. 6 Soils Off NSNJ Property:

EPA disagrees with the statement that the lead contamination in soil sample locations 44, 44A and 60-64 are inconsistent with airborne dispersion patterns and the wind rose for the area. Airborne disposition is a likely source of East Stream area lead contamination. Figure 4, of the October 1990 RI Report indicates that the strongest winds are coming from the westerly and south-westerly direction would transport airborne emissions directly toward the East Stream area. This is also evidenced by most off-site contamination east of the plant being within the first three inches of soil. Based upon this information, the last two sentences of this paragraph (thus, the lead ..... not related to the site) are hereby deleted.

Pg. 8 Tabular summary of WET evaluation, first column.

The first two rows of the table are incorrectly listed as Ground Water Discharge. The first row should be listed as Ground Water Recharge.

Pg. 17 Note that the West Stream will be remediated as part of Phase V of EPA's Removal Action at the NL site. Therefore, the West Stream remediation will not be addressed under Operable Unit One.

Pg. 26 1.2.5 Baseline Risk Assessment The FS Report's discussion of risk is not sufficient. The second paragraph is hereby deleted and replaced with the

following discussion of human health and ecological risks. In addition, summary tables for site risks may be found in Attachment B to this Addendum. Please note that the risk contribution from lead, which can not be quantified, is not included in these summary tables.

Pg. 29 1.2.6 Applicable or Relevant and Appropriate Requirements (ARARs): ARARs regarding Floodplains and Agricultural Lands must be addressed prior to commencement of remedial activities.

SUMMARY OF SITE RISKS

Human Health Risk Assessment

Based upon the results of the RI, a baseline risk assessment was conducted to estimate the risks associated with current and future site conditions. The baseline risk assessment estimates the human health risks which could result from the contamination at the site if no remedial action were taken.

A four-step process is utilized for assessing site-related human health risks for a reasonable maximum exposure scenario: Hazard Identification--identifies the contaminants of concern at the site based on several factors such as toxicity, frequency of occurrence, and concentration. Exposure Assessment--estimates the magnitude of actual and/or potential human exposures, the frequency and duration of these exposures, and the pathways (e.g., ingesting contaminated well-water) by which humans are potentially exposed. Toxicity Assessment-- determines the types of adverse health effects associated with chemical exposures, and the relationship between magnitude of exposure (dose) and severity of adverse effects (response). Risk Characterization-- summarizes and combines outputs of the exposure and toxicity assessments to provide a quantitative (e.g., one-in-a-million excess cancer risk) assessment of site-related risks.

The baseline risk assessment began with selecting contaminants of concern which would be representative of site risks. These contaminants included the inorganic compounds (i.e., metals) antimony, arsenic, beryllium, cadmium, chromium, nickel, and zinc, and the organic compounds 1,1-dichloroethane, 1,1-dichloroethene, 1,1,1-trichloroethane, tetrachloroethene, and vinyl chloride. Several of the contaminants, including arsenic, beryllium, and the five organics above are known to cause cancer in laboratory animals and are suspected to be human carcinogens.

The baseline risk assessment evaluated the health effects which could result from exposure to contamination from soils (ingestion, dermal contact, and inhalation of wind-borne compounds), and ground water (ingestion, inhalation of volatiles while showering, and dermal contact). The risk assessment considered the site's current land use as an abandoned industrial facility, and the future land uses as either an industrial facility or residential area. Current receptors included off-site residents (child and adult) and off-

site workers. Future receptors included on-site residents (child and adult), off-site residents (child and adult), on-site workers, and off-site workers. Ground water use was only considered for future exposure scenarios.

EPA uses reference doses (RfDs) and slope factors to calculate the noncarcinogenic and carcinogenic risk attributable to a particular contaminant. An RfD is an estimate of a daily exposure level that is not likely to result in any appreciable risk of deleterious effects during a person's lifetime. A slope factor establishes the relationship between the dose of a chemical and the response and is commonly expressed as a probability of a response per unit intake of a chemical over a lifetime.

Although EPA has established RfDs and slope factors for chemicals evaluated in the baseline risk assessment, lead currently does not have a RfD, slope factor, or similarly accepted toxicological parameters. Consequently, the risk due to lead cannot be quantified. This is of particular significance at the NL site, since lead is the major contaminant of concern. Therefore lead, which was qualitatively evaluated independent of the other contaminants of concern, will be discussed separately from the quantitative baseline risk assessment.

The results of the quantitative baseline risk assessment indicate that all exposures to receptors under current land use are acceptable, both in terms of cancer and non-cancer risk. Under potential future land use, all receptors except the on-site worker, have unacceptable risks for both cancer and non-cancer effects due to ground water ingestion. In addition, all future residents have unacceptable cancer risk via the inhalation of ground water contaminants while showering. The only other unacceptable non-cancer risk under the future land use scenario is that to the on-site child resident, both by ingesting and dermally contacting contaminated soil.

The greatest carcinogenic risk accrues to the (hypothetical) future residents (on-site and off-site) through their ingestion of ground water. The cancer risk is 2×10^{-3}, meaning that 2 excess cancers per 1,000 residents could occur if future residents were to use the contaminated ground water. Current Federal guidelines for acceptable exposures are a maximum excess carcinogenic risk in the range of 10^{-4} to 10^{-6}. The lowest unacceptable cancer risk (3×10^{-4}) is estimated to occur to the 10-12 year old resident, inhaling ground water contaminants while showering.

All future residents (children and adults) and the future off-site worker, have unacceptable non-cancer risk. The on-site child resident would have the most significant risk of all of these through ground water ingestion, with a Hazard Index of 17. A hazard index greater than 1.0 indicates that the exposure level exceeds the protective level for that particular chemical. Current Federal guidelines for acceptable exposures are a maximum hazard index of 1.0. The lowest unacceptable hazard index, which is for

the off-site adult resident inhaling volatile ground water contaminants while showering, was 1.0.

As discussed earlier, lead currently does not have a RfD, slope factor, or similarly accepted toxicological parameters and could not be evaluated in the quantitative baseline risk assessment. Therefore, the risks posed by lead have been qualitatively evaluated below for site soils, sediment, and ground water.

Elevated concentrations of lead have been detected on site in the soils, sediments, surface water and ground water. Exposure to lead has been associated with human noncarcinogenic effects. The major adverse effects in humans caused by lead include alterations in red blood cell production and the nervous system. High concentrations in the blood can cause severe irreversible brain damage and possible death. EPA has also classified lead as a "B2" carcinogen, which indicates that it is considered a probable human carcinogen.

With regard to all exposure scenarios considered in the baseline risk assessment, where there was a non-acceptable cancer or non-caner risk, it is plausible that the cumulative cancer risk and hazard indices would be even higher if the effects of lead be quantitatively included.

Ecological Risk Assessment

A four-step process is utilized for assessing site-related ecological risks for a reasonable maximum exposure scenario: Problem Formulation - a qualitative evaluation of contaminant release, migration, and fate; identification of contaminants of concern, receptors, exposure pathways, and known ecological effects of the contaminants; and selection of endpoints for further study. Exposure Assessment--a quantitative evaluation of contaminant release, migration, and fate; characterization of exposure pathways and receptors; and measurement or estimation of exposure point concentrations. Ecological Effects Assessment--literature reviews, field studies, and toxicity tests, linking contaminant concentrations to effects on ecological receptors. Risk Characterization--measurement or estimation of both current and future adverse effects.

The ecological risk assessment was conducted during 1992 at the site by EPA's Environmental Response Team. It included a study of contaminant uptake by ecological receptors located at the site, as well as bioaccumulation modelling of contaminant uptake by higher organisms. The results of the ecological study and risk assessment were used in developing remedial action objectives.

The two media potentially posing risks to non-human receptors at the NL site are the stream sediments and wetland soils. These media also contribute to degradation of surface water quality in the East and West Streams and drainage channel. The contaminants of concern are metals, with lead being the most widespread, and detected at much higher levels than other metals. For this reason, a site-specific ecological assessment was performed to determine a

risk-based clean-up level for lead only, with the assumption that a clean-up commensurate with a protective level of lead would also result in protective levels of the other metals to the ecological receptors. Lead from site soils and sediments enter the food chain via absorption and ingestion. The bioavailability of soil- and sediment-bound lead accumulated by specific components of the food chain, such as small mammals, earthworms and frogs. This data is then utilized in the evaluation of the exposure of lead to organisms which are not directly sampled.

Lead in site soils becomes available to terrestrial fauna (e.g., small mammals) and avian forms when they feed upon earthworms, the latter accumulating body burdens of lead through their deposit-feeding activity. The sediment-borne lead is available for uptake by amphibians (e.g., frogs) that frequent the site's two streams.

Exposures to earthworms were manipulated in the field investigation to be in the range of 120-6,900 ppm dry weight of soil. Although lethality as an endpoint was monitored, the bioaccumulated lead in the worm tissues after the study was recorded for use in a modelling exercise to determine whether this posed a toxicological threat to earthworm predators (i.e., robins, and woodcocks). In a similar fashion, green frogs found on site had their tissues analyzed for lead content. This information was modelled for the potential toxicological threat posed to their natural predators found at the site, the great blue heron, and the mink. Finally, the white-footed mouse was selected as a representative terrestrial species serving as a diet item of the red-tailed hawk, the long-eared owl, the red fox, and the mink.

A hazard quotient approach was utilized to evaluate the likelihood that lead concentrations in site media and animal tissues would produce deleterious effects. In this method, exposure levels are compared to levels which have been shown to cause toxicological effects (i.e., daily lead intake/reference dose = Hazard Quotient). A hazard quotient greater than 1.0 indicates that exposure to contaminants at calculated levels may cause deleterious effects. Results of the risk calculations suggest that potentially significant risk exists at the site at concentrations at and above 500 ppm for the following species (and with the following associated toxicological endpoint): robin and woodcock nestlings (reduced brain weight and hematocrit), red fox (anorexia and convulsions), and mink (reduced population).

The result of the ecological risk assessment indicate a clean-up level of 500 ppm for lead in site soils and sediments is appropriate to address the significant risks to ecological receptors.

SECTION 2 - IDENTIFICATION AND SCREENING OF TECHNOLOGIES

Pg. 33,34 Last paragraph of pg. 33 and first paragraph of pg. 34, up to "Pursuant to USEPA request..." is hereby deleted. This text draws inaccurate conclusions regarding the

Ecological Assessment. The text also makes misleading statements regarding leachability and protectiveness of human health and biota.

Pg. 35,36 The FS Report speculates that "... it is possible that some upstream source that affects the water quality in these (upstream) tributaries also affects water quality north of U.S. Route 130." It is EPA's opinion that much of the lead contamination present in soils and sediments which do not receive surficial runoff from the site is due to aerial deposition from the operations of the NL Industries facility.

Pg. 36 3rd paragraph, "Excavation of the stream segments..." to the end of the paragraph is hereby deleted and replaced with the following:

Excavation of the stream sediments north of Route 130 would be conducted in a manner to minimize resuspension of contaminated sediments. Although the stream is too large to be diverted north of Route 130, hydraulic vacuums and sediment control devices would be used to prevent excavation activities from adversely impacting existing flora and fauna, or spreading contaminants downstream.

Pg. 36 The last paragraph (pg 36 and following quote on pg. 37) is based upon an EPA's draft Ecological Assessment and is hereby deleted. EPA's final Report and recommendations may be found in the administrative record for the site.

Pg. 39 The first paragraph, which speculates whether the remediation of sediments north of Route 130 would be beneficial is inaccurate and is hereby deleted. Benefits of this remediation are described in EPA's Proposed Plan for Operable Unit One of the site.

Pg. 44 Second Paragraph, second sentence. This sentence incorrectly states that discharge of treated ground water to the Delaware River is rejected on the basis of cost. This alternative, however, is retained throughout the FS Report.

Pg. 47 <u>SECTION 3 - DEVELOPMENT AND SCREENING OF ALTERNATIVES</u>

EPA has modified the soil alternatives as described in the Executive Summary Section of this Addendum. These modifications make the alternatives consistent with each other where appropriate, with EPA policy and with data collected at the site.

The detailed breakdown of the costs and volumes of soil for the modified alternatives may be found in Attachment A to this addendum. Note that EPA's modified soil alternatives include treatment and disposal of the

excavated stream and drainage channel sediments. Thus, the soil alternatives now include an increased volume of soil (and sediment), while the sediment alternative do not include treatment and disposal of the sediments.

Pg. 49-52 Soil Alternatives B and D: Soil Washing

These sections of the FS Report are unjustly critical of soil washing as a remedial treatment for contaminated soils. Concerns regarding the applicability of soil washing to the site would be addressed during laboratory, bench and pilot-scale tests.

Soil washing is an innovative treatment technology. A treatability study would be performed to determine the optimum design parameters for any soil washing system. Soil washing is expected to be effective in rendering the soils non-hazardous and is likely to achieve the remedial action objective for significant amounts of the treated soil, especially if combined with an acid extraction (leaching) process. Soil washing, combined with on-site landfilling, would minimize the amount of soil necessary to import as backfill for the site, and would reduce the mobility of all soils above the remedial action objective. It also would permanently reduce the toxicity and volume of contaminants in the most highly contaminated portions of the soil.

The FS Report tends to inflate the cost of soil washing. Based upon vendor information, there is a significant economy of scale for soil washing treatment systems (See Attachment C). Vendor-provided information indicates that treatment cost may be as low as $115/ cubic yard, compared to the estimate of $200/cubic yard provided in the FS Report. However, the conservative assumption of $200/cubic yard has been carried through in the modified cost tables.

In addition, the examples of previous soil washing failures that are cited in the FS Report are of questionable relevance to the NL site soils or only represent one of many possible soil washing approaches. These approaches encompass a wide range of processes including size separation, gravity separation, attrition scrubbing and solubilization via surfactants, solvents, acids or chelating agents that may be employed in various combinations. The FS Report cited soil washing attempts which contained pre-1990 information, and there has been a significant effort since that time related to acid extraction from lead soils.

Of particular significance is a test that the Center for Hazardous Materials Research (CHMR) performed under EPA's Emerging Technology Program with soils obtained from the NL site. The extraction process reduced lead

concentrations from 30,000 ppm to about 1,000 ppm. In addition, the US Bureau of Mines and several private companies are exploring several promising treatment processes for the extraction of lead from soils.

Pg. 56 First Paragraph

Note that since surface water discharge criteria for several metals in freshwater are hardness dependent, a hardness of 100 ppm was assumed for the East and West Streams in developing specific criteria. Attachment D contains EPA's estimated discharge criteria for the East and West Stream for contaminants detected at the site.

Pg. 57 3.3.2 Groundwater Alternatives

The third sentence is hereby deleted and replaced with; "Pending further evaluation during the remedial design phase of the project, the existing well point system may be used in part to achieve the desired ground water recovery."

Based upon New Jersey Surface Water Standards, New Jersey Ground Water Standards, and Federal Ambient Water Quality Criteria, the effluent limit for Total Dissolved Solids (TDS) for discharge of treated ground water to the East or West Stream, the infiltration pond, the unconfined and confined aquifer is 500 ppm. In all likelihood, discharge to these locations will require the use of a reverse osmosis (RO) unit to reduce TDS in the effluent to an acceptable level. This applies throughout the FS Report. Note that the FS Report did not initially take this into consideration in developing the ground water discharge alternatives.

Based upon preliminary information, it appears that TDS effluent limits for Delaware River discharge (Alternative G-2) may be up to 5,000 ppm. This would likely not require the use of an RO unit to achieve these TDS levels.

Pg 58,59, 60 Groundwater Alternatives C, D and E

EPA does not concur with the statement that "clay content in the upgradient areas potentially increases, further reducing the potential for infiltration at a rate acceptable for anticipated recovery rate." The rationale for this statement is not given in the FS Report.

Pg. 60 3.3.7 Groundwater Alternative G - Pump and Treat with Direct Discharge to Surface Water

The FS Report states that the surface water discharge criteria for lead (based on AWQC) in the East and West

Stream, and Delaware River are 0.07 ppb and 0.10 ppb, respectively. This statement is incorrect and is hereby deleted from the FS Report. The AWQC for the East or West Stream would be approximately 3.2 ppb for lead. This value is hardness dependent and assumes a hardness of 100 mg/l in the receiving surface water body. Discharge criteria for the Delaware River would be developed by NJDEPE pending an anti-degradation review and would include the effects of dilution. Note that dilution is not likely in the East or West Streams since they are intermittent streams.

Pg. 62 Sediment Alternatives

Note the changes to the sediment alternatives described in the Executive Summary.

SECTION 4 - DETAILED EVALUATION OF ALTERNATIVES

Pg. 70 First Full Paragraph.

It is stated that, ".....groundwater monitoring will be sufficient to monitor potential migration of lead found in surface soils." Soil and surface water monitoring must be included in the long-term monitoring program because, as stated on page 71, contaminants can migrate through wind and surface water erosion.

Pg. 77 See soil washing discussion for pages 49-52.

Pg. 82 4.2.3.5 Short-Term Effectiveness

It is stated that "mature on-site trees will not be removed during or after the implementation of this alternative." This should be replaced with the statement that "....the removal of mature on-site trees will be minimized during the implementation of this alternative."

Pg. 83 Note that all soil alternatives (except the No-Action alternative) would disturb approximately nine acres of wetlands which must be remediated (using the 500 ppm of lead as a cleanup level). Attachment E shows that the additional wetland destruction due to construction of the on-site landfill is up to 0.32 acres, depending upon the landfill capacity, with a maximum landfill capacity of approximately 54,000 cubic yards. Any wetlands destroyed or impacted as part of the site's remediation would require mitigation.

Pg. 84 See modifications to soil alternatives, regarding treatment requirements, discussed in the Executive Summary section of this Addendum.

Pg. 91 4.2.5.5 Short-Term Effectiveness

Same modification as for page 82.

Pg. 92 4.2.5.6 Implementability

Third sentence.

"The soils curbing areas..." should read "The soil curing areas...."

Pg. 95 4.2.6.5 Short-Term Effectiveness

In the second paragraph, it is stated that "implementation of soil Alternative F may affect nine acres of wetland areas AA3, AA6 and AA7." Note that implementation of Alternative F may also affect wetland area AA5 (see Figure 28.)

Pg. 99 Last Paragraph, First Sentence.

In discussing Soil Alternative G, it is stated that "It is estimated that the soil excavation, off-site disposal, site restoration, and capping could be completed in nine months." However, Soil Alternative G - Excavation of All Soils Above Action Level/Off-Site Disposal) does not involve capping and is estimated to take 24 months to complete.

The following discussion supplements Section 4.3 (Pgs. 105-133) of the FS Report, which compares the ground water alternatives with respect to the evaluation criteria.

GROUND WATER

Overall Protection of Human Health and Environment: Ground-water Alternatives B, E, F, G-1 and G-2 would all be protective of human health by restoring the unconfined aquifer to drinking water standards. However, Alternative B would create an artificial water body containing lead concentrations greater than ambient surface water quality criteria. Therefore, it would not be protective of the environment compared with the other alternatives. Alternatives B, E and F would treat water to drinking water standards and Alternatives G-1 and G-2 would be protective of the environment by treating ground water to the appropriate ambient surface water criteria prior to discharge to the on-site streams or the Delaware River, respectively.

Compliance with Applicable or Relevant and Appropriate Requirements: All alternatives except Alternative A, No-Action, would comply with ARARs. Primary ARARs of concern include the Safe Drinking Water Act, the New Jersey Ground Water Quality Water Standards and the associated Practical Quantitation Limits, New Jersey Surface Water Standards, and Federal Ambient Water Quality Criteria. For Alternative F, the NJ anti-degradation policy

applies, and would be complied with. For Alternative G-1, all substantive NJPDES permit requirements would be met. For Alternative G-2, a NJPDES permit for surface water discharge would be obtained.

The treatment system included for all alternatives, except Alterative A, No Action, is conceptually designed to achieve compliance with chemical specific ARARs for the discharge either to the confined aquifer, the unconfined aquifer, the on-site streams, or the Delaware River at the estimated costs presented in this Proposed Plan. However, if upon operation of the treatment system, it is determined that the selected discharge requirements cannot be achieved, ARARs may be waived pursuant to the statutory waiver provisions of Section 121(d) of CERCLA, based on the technical impracticability of achieving further contaminant reduction.

Long-term Effectiveness and Permanence: All alternatives except for Alternative A would be designed to treat the ground water to meet remedial action objectives and permanently reduce the magnitude of residual risk. Alternatives B and E would have significant, impacts on ground-water flow patterns in the unconfined aquifer which may lead to mounding. Mounding could have a negative impact on existing structures in the vicinity of the site. Alternatives G-1 and G-2 are preferable to Alternatives B and E in that impacts to ground-water hydrology are minimal. Alternatives B, E and F would be designed to treat water to ground-water standards while Alternatives G-1 and G-2 would be designed to treat to surface-water standards.

Reduction of Toxicity, Mobility or Volume Through Treatment: All alternatives except Alternative A would permanently reduce the toxicity, mobility and volume of contamination in the unconfined aquifer through treatment technologies employed in the remedy. The treatment technology for each alternative is described under the Summary of Alternatives section, above.

Short-term Effectiveness: All alternatives, except Alternative A, No Action, would take approximately the same time to complete construction and be implemented. Containment of the contaminant plume may be achieved within approximately 1 to 3 years of operation for Alternatives B, E, F and G. In general, however, restoring an aquifer to remedial action objectives may require treatment and operation in the order of 30 years.

Implementability: Alternative B would be the most difficult to implement because it requires the acquisition of 10 acres of land off site to place the infiltration pond. In addition Alternatives B and E may be difficult to implement due to potential for mounding in the unconfined aquifer due to the high water table and low transmissivity of the aquifer. Mounding may lead to a negative impact to existing structures in the vicinity of the site, as well as the existing on-site landfill. Alternatives B, E, F, G-1 and G-2 would require similar and available treatment technology and can be constructed on-site. All of these alternatives, except Alternative G-2 would require a reverse osmosis unit to remove TDS in the

effluent stream. The reverse osmosis unit requires significant maintenance to ensure efficiency.

The system for surface discharge associated with Alternative G-1 would be easier to construct and maintain than the reinjection components of Alternatives E and F, since reinjection systems are more prone to malfunction due to siltation. For Alternative G-2, a pipeline would be constructed from the site, approximately 1 1/2 miles to the Delaware River to transport and discharge treated ground water. The pipeline could be constructed using standard construction techniques. However, appropriate access agreements must be obtained prior to construction. The discharge pipe would also have to cross underneath the rail road tracks and Route 130, which may require additional access agreements and permits from state and local government, and private parties. Construction of such a pipeline in marshy areas and wetlands may be difficult to implement. Finally, Alternative G-2 may require additional sampling in order to determine discharge limits for each contaminant under a permit.

Cost: Except for the No Action Alternative, all of the groundwater alternatives would utilize treatment systems that are similar in design, and all alternatives are within 20 percent of each other in costs. The alternatives differ from each other primarily in the method of discharging treated groundwater and the level of treatment needed to meet established discharge standards. All alternatives which include reverse osmosis in the treatment system (Alternatives B, E, F, and G-1) require higher operation and maintenance costs for the same time duration than the alternatives not requiring such a unit (Alternatives A and G-2).

Pg. 109 Last Paragraph.

For ground water in the vicinity of monitoring wells 11, BR and SD, where organic contaminants were found, Vapor Phase Carbon Adsorption may be required along with air strippers for air pollution control when contaminated ground water is extracted.

In addition, as described earlier, a RO treatment unit would likely be required as part of the treatment system for all groundwater discharge options except for discharge to the Delaware River (Ground Water Alternative G-2).

Pg. 114 <u>4.3.2.6 Implementability</u>

Second Paragraph.

"New Jersey Groundwater Standards" should be replaced with "the New Jersey PQL of 10 ppb for lead."

Pg. 127 See modification for Pg. 109 regarding RO.

Pg 133 -157 Sediment Alternatives Sections 4.4-4.6

The discussion and evaluation regarding stream sediment alternatives (Alternative A, No Action, and Alternative B, Excavation) is modified as described in the Executive Summary section of this Addendum. The alternatives were modified to encompass the contaminated East Stream and drainage channel sediments. The West Stream will be addressed through EPA's Removal Action. Note that site-related contamination extends from the East and West Streams through the drainage channel toward the Delaware River. The following discussion modifies Section 4.4-4.6 in the FS Report with respect to the evaluation criteria for sediments.

Overall Protection of Human Health and Environment:

Only Alternative B provides adequate protection of human health and the environment. Human health and environmental risks posed through each pathway are eliminated by removing the contaminated media from the environment.

Compliance with Applicable or Relevant and Appropriate Requirements:

Alternative B could be performed in accordance with ARARs and would meet remedial action objectives. Sediments contribute to the contamination of surface water in the streams and drainage channel. Contamination in surface water is currently above the Federal Ambient Water Quality Criteria and New Jersey Surface Water Standards. Alternative B would address the remediation of surface water contamination through removal of the sediments above the remedial action objective, which are a source of surface-water contamination.

Long-term Effectiveness and Permanence

Alternative B would eliminate residual risk. In conjunction with remediation of surrounding site soils, this alternative would maintain reliable protection of human health and the environment after the remedial action objective has been met.

Reduction of Toxicity, Mobility, or Volume Through Treatment:

For Alternative B, reduction of toxicity, mobility and volume through treatment would depend upon the selected soil alternative since sediments would be treated, to the degree possible, in the same manner as the soils. However, through the excavation of contaminated sediments in the East Stream and drainage channel, toxicity, mobility and volume of contamination in these water bodies would be reduced.

Short-term Effectiveness:

Alternative B would be effective in the short term and would quickly achieve the remedial action objective. However, normal water flow would be disrupted during remediation. In addition, procedures would need to be implemented to minimize the resuspension and control of contaminated sediment during remediation.

Implementability:

Alternative B is readily implementable using standard construction techniques. However, engineering controls would be required to prevent further contamination while sediments are being excavated.

Cost:

Alternative B is estimated to cost $2,148,200 to remediate the contaminated East Stream and drainage channel sediments to the remedial action objective.

Pg. 146 The FS Report assumes that 50 percent of the sediments north of Route 130 will be classified as hazardous waste (i.e., will fail the TCLP test). This assumption is erroneous and has been modified to be consistent with the soil assumptions (approximately 30 percent will be hazardous waste). Even this assumption is conservative, since data shows that sediments north of Route 130 are generally below 2,000 ppm of lead, which was the approximate concentration above which soils failed the TCLP test. Therefore, the soils would likely not be characterized as hazardous waste.

Section 4.5.2.1. References in the FS Report stating or implying that the removal of sediments would be potentially disruptive and may adversely affect stream populations are hereby removed, as is Dr. Sprenger's quote from the Draft Ecological Risk Assessment. Dr. Sprenger's final recommendations, which may be found in the administrative record, conclude that sediments in excess of 500 ppm of lead should be removed from the stream and drainage channel to address ecological risks posed by these sediments. As stated earlier, engineering controls would be employed during remediation to minimize sediment resuspension and disruption to the East Stream and drainage channel.

Pg. 148 <u>4.5.2.4 Reduction of Toxicity, Mobility, or Volume Through Treatment</u>

The statement that "The toxicity, mobility, or volume of lead in sediments will not be reduced through treatment by this alternative (Sediment north of U.S. Route 130 Alternative B - Mechanical Dredging)" is incorrect and

hereby delated. Toxicity, mobility and volume, of lead in sediments would be reduced since dredged sediments would be managed in accordance with the selected soil remedial alternative

Pg. 150 4.5.3 Summary

This section states that remediation of the sediments in the drainage channel is not justified. This statement is inaccurate and is hereby removed.

Pg. 152 Balancing Criteria

Second Paragraph.

It is stated that "Soil Alternatives C, E and F increase the volume of soil to be managed by 50% because of the addition of binding agents to the soil." It must be noted that volume increase would only be for the hazardous (solidified/stabilized) fraction of the soil to be treated, not all excavated soil. The hazardous fraction of soil is expected to be approximately one third of the total volume of soil above the remedial action objective of 500 ppm of lead.

Pg. 153 The first full paragraph, regarding Soil Alternative F, is hereby removed.

Pg. 155-157 Note that Sediment Alternatives are combined as described in the Executive Summary section of this Addendum, and are evaluated according to the evaluation criteria (added under modifications to pages 134-150 in this Addendum).

Pg. 157 Overall Protection of Human Health and the Environment

The statement that "Sediment Alternative A (No Action) will not be protective of human health, but could be protective of the environment..." is incorrect and hereby deleted. Based upon the results of EPA's ecological assessment, leaving contaminated sediment above the remedial action objective of 500 ppm of lead would not be protective of the environment because of risks due to the exposure of biota and wildlife to lead in this media.

Pg. 157 Balancing Criteria

The last sentence is incorrect and is hereby deleted.

TABLES

The attached modified cost tables for soil and sediment alternatives in Attachment A replace cost tables for soil and sediment alternatives in the FS Report. Ground water alternative cost tables have not been modified. A

discussion of major changes made by EPA to each cost table is described as follows:

In modifying each table, the following assumptions were made: As stated above, East Stream sediments and sediments from the drainage channel north of Route 130 are addressed by Operable Unit One. These sediments would be treated under the various soil alternatives, after excavation. The cost of treating these sediments was not addressed in the FS Report, however, the revised cost tables reflect the cost of treatment of these sediments under each soil alternative. In revising the cost tables, the volume of sediments from the drainage channel north of Route 130 was estimated to be 7,500 cubic yards (cy). The volume of East Stream sediments was estimated to be 800 cy (400 cy sediments and 400 cy cement used for dewatering). West Stream sediments are excluded because removal and remediation of West Stream sediments will be undertaken by EPA during Phase V of the Removal Action. Therefore, the total volume of sediments to be remediated under this alternative is now 8,300 cy. A swell factor of 10% volume increase was used to account for the expansion that occurs when soils are loaded into trucks.

TABLE - 6 SOIL ALTERNATIVE - A
NO ACTION/INSTITUTIONAL CONTROLS

No changes are made except the calculation for present worth cost. The math was corrected for present worth and total estimated costs.

TABLE - 8 SOIL ALTERNATIVE - B
EXCAVATION/SOIL WASHING OF ALL SOILS/RETURN TREATED SOILS TO SITE/DISPOSAL

It is assumed that 70% of soil and sediments above remedial action objectives would be remediated by soil washing, whereas 30% of the soils and sediments would need further treatment after soil washing by solidification/stabilization. These estimates would be refined based on results of the soil washing treatability study. For cost estimation purposes, it was assumed that solidified soil would be transported and disposed of at an off-site facility. A volume increase of 50% is assumed after solidification/stabilization. Costs and soil/sediment volumes have been modified in this table accordingly.

TABLE - 10 SOIL ALTERNATIVE - C

EXCAVATION/SOLIDIFICATION/STABILIZATION OF ALL SOILS/CONSOLIDATION ON-SITE

Under this alternative, all soil and sediment would be stabilized on-site. A volume increase of 50% is assumed after solidification/stabilization. It is assumed that the on-site landfill could accommodate up to approximately 53,700 cy, based on Table-10 of the FS Report. Excess stabilized soil (9,300 cy) would be transported and disposed off-site at a permitted facility. Costs and soil/sediment volumes have been modified in this table accordingly.

TABLE - 12 SOIL ALTERNATIVE - D
EXCAVATION/SOIL WASHING OF HAZARDOUS SOIL ON-SITE CONSOLIDATION/ DISPOSAL

It is assumed that 30% of the total volume of soil and sediment would be hazardous (based on TCLP testing) and therefore would be treated by soil washing. The remaining 70% of the soil and sediment would be non-hazardous and would be landfilled on-site. It was assumed that 70% of the washed soil would be treated to meet the remedial action objective and would be backfilled. The remaining 30%, which would consist mostly of fines, would be solidified/stabilized and disposed of off-site at an approved facility. A volume increase of 50% was assumed after solidification/ stabilization. Costs and soil/sediment volumes have been modified accordingly.

TABLE - 14 SOIL ALTERNATIVE-E
EXCAVATION/ON-SITE SOLIDIFICATION/STABILIZATION OF HAZARDOUS SOILS/DISPOSAL

It was assumed that 70% the total volume of soil and sediments is non-hazardous (based on TCLP testing) and would be landfilled on-site. The hazardous 30% of the total volume of soil and sediments would be solidified/ stabilized and disposed of off-site. A volume increase of 50% was assumed after solidification/stabilization. Costs and soil/sediment volumes have been modified accordingly.

TABLE - 16 SOIL ALTERNATIVE-F
EXCAVATION/ON-SITE SOLIDIFICATION/STABILIZATION OF HAZARDOUS SOILS/CONSOLIDATION ON-SITE

It was assumed that 70% the total volume of soil and sediments is non-hazardous (based on TCLP testing) and would be landfilled on-site. The hazardous 30% of the total volume of soil and sediments would be solidified/

stabilized and also landfilled on-site. A volume increase of 50% was assumed after solidification/ stabilization. Costs and soil/sediment volumes have been modified accordingly.

TABLE - 18 SOIL ALTERNATIVE-G
EXCAVATION/OFF-SITE DISPOSAL

It was assumed that 70% the total volume of soil and sediments is non-hazardous (based on TCLP testing) and would be transported and disposed of at an off-site disposal facility. Of the remaining hazardous 30% of the total volume of soil and sediments, it was assumed that 50% would be land disposable hazardous waste (not requiring treatment before disposal) and disposed of at an appropriate facility. The remaining 50% of hazardous soils/sediments was assumed to be non-land disposable would require treatment prior do disposal at an appropriate facility. Costs and soil/sediment volumes have been modified accordingly.

TABLE-27 SEDIMENT ALTERNATIVE-A, NO ACTION

Sediment Alternatives for the East Stream and drainage channel north of Route 130 are hereby combined as one sediment alternative. Remediation of the West Stream is excluded from the FS Report because removal and remediation of West Stream sediments would be undertaken by EPA during Phase V of the Removal Action. Sediment volumes and costs have been modified in this table accordingly. Note that the cost of treating any excavated sediments is included in the cost of the soil alternatives.

TABLE - 31 SEDIMENT ALTERNATIVE-B
SEDIMENT EXCAVATION/DREDGING

Sediment Alternatives for the East Stream and drainage channel north of Route 130 are hereby combined as one sediment alternative. Remediation of the West Stream is excluded from the FS Report because the removal and disposal of West Stream sediments will be undertaken by EPA during Phase V of the Removal Action. Sediment from the East Stream and drainage channel north of Route 130 would be treated with excavated, contaminated soils in accordance with the selected soil alternative. Therefore, treatment and disposal costs are not included here. The cost of confirmatory sediment sampling was included for the East Stream and drainage channel north of Route 130.

TABLES - 20, 21, 22, 23, 24, 25 and 26

Note that the cost for Vapor Phase Carbon Adsorption was not included with the Volatile Organic Compound (VOC) treatment system for air pollution control.

FIGURES

Figure 7

Soil sample locations such as 61, 209, 214, 306, which exceed 500 ppm of lead are missing from this figure. These may be found in Figure 8 of Remedial Investigation Report (October 1990).

Figures 23 and 24

These figures should have included all contaminated soil within the factory complex area. The figures have excluded non-paved areas within the factory area. All contaminated soils above the remedial action objective within the factory complex must be remediated along with site soils above the remedial action objective.

Figures 32.1 and 32.2

"Extent of soil removal" should read "Extent of sediment removal."

Figures 33, 34, 35 and 36

"Plume Delineation Based on USEPA Action Level of 10 ppb for Lead" should read "Plume Delineation Based on the New Jersey Practical Quantitation Level (PQL) of 10 ppb for lead."

APPENDIX B

Note that several ground water ARARs have been updated. These are attached as Attachment E to this Addendum.

ATTACHMENT A
MODIFIED COST ESTIMATES FOR SOIL AND SEDIMENT ALTERNATIVES

NL INDUSTRIES SITE
OPERABLE UNIT ONE
PEDRICKTOWN, NEW JERSEY

JULY 1993

NL Industries, Inc. Site
Soil Alternative A -Cost Estimate (1,3)
NO ACTION/INSTITUTIONAL CONTROLS

Item (2)	Quantity	Units	Unit Cost	Extended Cost	Total Cost
DIRECT CAPITAL COSTS					
Site Preparation					
Mobilization/Site Prep.	1.00	LS	$5,000.00	$5,000	
Site Work					
Clear and Grub	1.00	ACRE	$8,000.00	$8,000	
Fencing	6,000.00	LF	$15.00	$90,000	
Subtotal					$103,000
TOTAL DIRECT CAPITAL COSTS:					**$103,000**
INDIRECT CAPITAL COSTS					
Contingency (25% +/-)				$26,000	
Engineering (15% +/-)				$15,000	
Administration (5% +/-)				$5,000	
TOTAL INDIRECT CAPITAL COSTS:					**$46,000**
TOTAL CAPITAL COSTS					**$149,000**
ANNUAL MAINTENANCE COSTS					
Inspections/Maintenance	1.00	LS	$2,000.00	$2,000	
TOTAL ANNUAL COSTS:					**$2,000**
PRESENT WORTH (30 YR @ 5%):					**$30,800**
TOTAL ESTIMATED REMEDIAL COST:					**$179,800**

Notes:
1. Cost estimate based on R.S. Means 1990 Construction Cost Data, and O'Brien & Gere Engineers, Inc. professional experience.
2. Line items provided to form budget cost only.
3. The costs in this table were developed based upon the data currently available and several assumptions necessary to evaluate the alternatives. Because of the incomplete nature of this data and the possibility that actual conditions may vary considerably from these base assumptions, these costs are not necessarily indicative of the actual remediation costs that will be incurred. These costs should only be used for the comparison of technical alternatives.

NL Industries, Inc. Site
Soil Alternative B (500 ppm) - Cost Estimate (1,2)
EXCAVATION/SOIL WASHING OF ALL SOILS/RETURN TREATED SOILS TO SITE/DISPOSAL

Item (3)	Quantity	Units	Unit Cost	Extended Cost	Total Cost
DIRECT CAPITAL COSTS					
Site Preparation					
Mobilization/Site Prep.	1.00	LS	$500,000.00	$500,000	
Road Relocation	1.00	LS	$35,000.00	$35,000	
Health and Safety Plan	1.00	LS	$20,000.00	$20,000	
Erosion/Sediment/Dust Control	1.00	LS	$50,000.00	$50,000	
Wooded Area Access	15.00	ACRE	$8,000.00	$120,000	
Treatability Testing	1.00	LS	$150,000.00	$150,000	
Subtotal					$875,000
Site Work					
Excavating/Loading (On-Site)	28,000.00	CY	$15.00	$420,000	
Excavating/Loading (Off-Site)	1,800.00	CY	$15.00	$27,000	
Sediments	8,300.00	CY	-	-	
Truck Haul	42,000.00	CY	$5.00	$210,000	
Confirmational Sampling	33.00	EA	$100.00	$3,300	
Subtotal					$660,300
On-Site Restoration					
Topsoil/Fill	22,000.00	CY	$20.00	$440,000	
Earthwork	27.00	ACRE	$5,000.00	$135,000	
Hydroseed	15.00	ACRE	$3,500.00	$52,500	
Wetlands Vegetation	12.00	ACRE	$15,000.00	$180,000	
Subtotal					$807,500
Off-Site Restoration					
Topsoil/Fill	2,450.00	CY	$20.00	$49,000	
Earthwork	3.00	ACRE	$5,000.00	$15,000	
Wetlands Vegetation	3.00	ACRE	$15,000.00	$45,000	
Subtotal					$109,000
Soil Washing/Disposal					
Soil Washing	42,000.00	CY	$200.00	$8,400,000	
Haul & Backfill With Clean Soil	29,500.00	CY	$5.00	$147,500	
Solidify Fines	12,500.00	CY	$100.00	$1,250,000	
Haul Solidified Fines Off-Site	18,750.00	CY	$50.00	$937,500	
Dispose Solidified Fines Off-Site	18,750.00	CY	$100.00	$1,875,000	
Bench Scale/Full Scale Demonstration	1.00	LS	$100,000.00	$100,000	
Subtotal					$12,710,000
TOTAL DIRECT CAPITAL COSTS					$15,161,800
INDIRECT CAPITAL COSTS					
Contingency (25% +/-)				$3,790,500	
Engineering (15% +/-)				$2,274,300	
Administration (5% +/-)				$758,100	
Permitting				$100,000	
TOTAL INDIRECT CAPITAL COSTS					$6,922,900
TOTAL CAPITAL COSTS					$22,084,700
ANNUAL MAINTENANCE COSTS					
Cap Maintenance	1.00	LS	$5,000.00	$5,000	
TOTAL ANNUAL COSTS					$5,000
PRESENT WORTH (30 YR @ 5%)					$77,000
TOTAL ESTIMATED REMEDIAL COST					$22,161,700

Notes:

1. Cost estimate in Final Feasibility Study Report prepared by O'Brien & Gere Engineers, Inc. were revised by Ebasco for quantity changes provided by USEPA. No unit prices were changed.
2. The costs in this table were developed based upon the data currently available and several assumptions necessary to evaluate the alternatives. Because of the incomplete nature of this data and the possibility that actual conditions may vary considerably from these base assumptions, these costs are not necessarily indicative of the actual remediation costs that will be incurred. These costs should only be used for comparison of technical alternatives.
3. Line items provided to form budget cost only.

NL Industries, Inc. Site
Soil Alternative C (500 ppm) - Cost Estimate (1,2)
EXCAVATION/SOLIDIFICATION/STABILIZATION OF ALL SOILS/CONSOLIDATION ON-SITE

Item (3)	Quantity	Units	Unit Cost	Extended Cost	Total Cost
DIRECT CAPITAL COSTS					
Site Preparation					
Mobilization/Site Prep.	1.00	LS	$200,000.00	$200,000	
Road Relocation	1.00	LS	$35,000.00	$35,000	
Health and Safety Plan	1.00	LS	$20,000.00	$20,000	
Erosion/Sediment/Dust Control	1.00	LS	$50,000.00	$50,000	
Wooded Area Access	15.00	ACRE	$8,000.00	$120,000	
Treatability Testing	1.00	LS	$50,000.00	$50,000	
Subtotal					$475,000
Site Work					
Excavating/Load (On-Site)	28,000.00	CY	$15.00	$420,000	
Excavating/Load (Off-Site)	1,800.00	CY	$15.00	$27,000	
Sediments	8,300.00	CY	-	-	
Truck Haul	42,000.00	CY	$5.00	$210,000	
Confirmational Sampling	33.00	EA	$100.00	$3,300	
Subtotal					$660,300
On-Site Restoration					
Topsoil/Fill	22,000.00	CY	$20.00	$440,000	
Earthwork	27.00	ACRE	$5,000.00	$135,000	
Hydroseed	15.00	ACRE	$3,500.00	$52,500	
Wetlands Vegetation	12.00	ACRE	$15,000.00	$180,000	
Subtotal					$807,500
Off-Site Restoration					
Topsoil/Fill	2,450.00	CY	$20.00	$49,000	
Earthwork	3.00	ACRE	$5,000.00	$15,000	
Wetlands Vegetation	3.00	ACRE	$15,000.00	$45,000	
Subtotal					$109,000
Solidification/Disposal					
Soil Treatment, On-Site	42,000.00	CY	$100.00	$4,200,000	
Volume of Solidified/Stabilized Material	63,000.00	CY	-	-	
Haul to On-Site Consolidation Area	53,700.00	CY	$5.00	$268,500	
Haul Off Site Non. Haz. Matl	9,300.00	CY	$50.00	$465,000	
Dispose Off Site Non. Haz. Matl	9,300.00	CY	$100.00	$930,000	
Subtotal					$5,863,500
On-site Consolidation Area					
Surface Prep/Cap Base Grading	9,500.00	CY	$5.00	$47,500	
Disposal Soil Grading	53,700.00	CY	$5.00	$268,500	
40 mil VLDPE Geomembrane	100,000.00	SF	$1.00	$100,000	
Drainage Layer (6")	1,800.00	CY	$10.00	$18,000	
Root Zone Soil (24" Layer)	7,500.00	CY	$15.00	$112,500	
Topsoil (6" Layer)	1,800.00	CY	$20.00	$36,000	
Seed, Fertilize, and Mulch	2.00	ACRE	$5,000.00	$10,000	
Liner System	1.00	LS	$600,000.00	$600,000	
Subtotal					$1,192,500
TOTAL DIRECT CAPITAL COSTS					**$8,107,800**
INDIRECT CAPITAL COSTS					
Contingency (25% +/-)				$2,277,000	
Engineering (15% +/-)				$1,366,200	
Administration (5% +/-)				$455,400	
Permitting				$100,000	
TOTAL INDIRECT CAPITAL COSTS					**$4,198,600**
TOTAL CAPITAL COSTS					**$13,306,400**
ANNUAL MAINTENANCE COSTS					
Cap Maintenance	1.00	LS	$5,000.00	$5,000	
TOTAL ANNUAL COSTS					**$5,000**
PRESENT WORTH (30 YR @ 5%)					**$77,000**
TOTAL ESTIMATED REMEDIAL COST					**$13,383,400**

Notes:

* Only 53,700 CY of treated soil can be placed in consolidation pile due to space limitation. Excess must be disposed off site.

1. Cost estimates in final Feasibility Study Report prepared by O'Brien & Gere Engineers Inc were revised by Ebasco for quantity changes previous by USEPA. No unit prices were changed.

2. The costs in this table were developed based upon the data currently available and several assumptions necessary to evaluate the alternatives. Because of the incomplete nature of the data and the possibility that actual conditions may vary considerably from these base assumptions, these costs are not necessarily indicative of the actual remediation costs that will be incurred. These costs should only be used for comparison of technical alternatives.

3. Line items provided to form budget cost only.

Table 12
NL Industries, Inc. Site
Soil Alternative D (500 ppm) - Cost Estimate (1,2)
EXCAVATION/SOIL WASHING OF HAZARDOUS SOIL/ON-SITE CONSOLIDATION/DISPOSAL

Item (3)	Quantity	Units	Unit Cost	Extended Cost	Total Cost
DIRECT CAPITAL COSTS					
Site Preparation					
Mobilization/Site Prep.	1.00	LS	$500,000.00	$500,000	
Road Relocation	1.00	LS	$35,000.00	$35,000	
Health and Safety Plan	1.00	LS	$20,000.00	$20,000	
Erosion/Sediment/Dust Control	1.00	LS	$50,000.00	$50,000	
Wooded Area Access	15.00	ACRE	$8,000.00	$120,000	
Treatability Testing	1.00	LS	$150,000.00	$150,000	
Subtotal					$875,000
Site Work					
Excavating/Load (On-Site)	28,000.00	CY	$15.00	$420,000	
Excavating/Load (Off-Site)	1,800.00	CY	$15.00	$27,000	
Sediments	8,300.00	CY	-	-	
Truck Haul	42,000.00	CY	$5.00	$210,000	
Confirmational Sampling	33.00	EA	$100.00	$3,300	
Subtotal					$660,300
On-Site Restoration					
Topsoil/Fill	22,000.00	CY	$20.00	$440,000	
Earthwork	27.00	ACRE	$5,000.00	$135,000	
Hydroseed	15.00	ACRE	$3,500.00	$52,500	
Wetlands Vegetation	12.00	ACRE	$15,000.00	$180,000	
Subtotal					$807,500
Off-Site Restoration					
Topsoil/Fill	2,450.00	CY	$20.00	$49,000	
Earthwork	3.00	ACRE	$5,000.00	$15,000	
Wetlands Vegetation	3.00	ACRE	$15,000.00	$45,000	
Subtotal					$109,000
On-Site Consolidation Pile					
Surface Prep/Cap Base Grading	7,400.00	CY	$5.00	$37,000	
Disposal Soil Grading	29,500.00	CY	$5.00	$147,500	
40 mil VLDPE Geomembrane	79,000.00	SF	$1.00	$79,000	
Drainage Layer (6")	1,400.00	CY	$10.00	$14,000	
Root Zone Soil (24" Layer)	5,800.00	CY	$15.00	$87,000	
Topsoil (6" layer)	1,400.00	CY	$20.00	$28,000	
Seed, Fertilize, and Mulch	1.80	ACRE	$5,000.00	$9,000	
Liner System	1.00	LS	$550,000.00	$550,000	
Subtotal					$951,500
Soil Washing/Disposal					
Soil Washing	12,500.00	CY	$200.00	$2,500,000	
Haul & Backfill With Clean Soil	8,750.00	CY	$5.00	$43,750	
Solidify Fines	3,750.00	CY	$100.00	$375,000	
Haul Solidified/Stabilized Fines Off-Site -Non Hazard	5,625.00	CY	$50.00	$281,250	
Dispose Solidified/Stabilized Fines Off-Site -Non Hazard	5,625.00	CY	$100.00	$562,500	
Bench Scale/Full Scale Demonstration	1.00	LS	$100,000.00	$100,000	
Subtotal					$3,862,500
TOTAL DIRECT CAPITAL COSTS					**$7,265,800**
INDIRECT CAPITAL COSTS					
Contingency (25% +/-)				$1,816,500	
Engineering (15% +/-)				$1,089,900	
Administration (5% +/-)				$363,300	
Permitting				$100,000	
TOTAL INDIRECT CAPITAL COSTS					**$3,369,700**
TOTAL CAPITAL COSTS					**$10,635,500**
ANNUAL MAINTENANCE COSTS					
Cap Maintenance	1.00	LS	$5,000.00	$5,000	
TOTAL ANNUAL COSTS					**$5,000**
PRESENT WORTH (30 YR @ 5%)					**$77,000**
TOTAL ESTIMATED REMEDIAL COST					**$10,712,500**

Notes:

1. Cost estimates in Final Feasibility Study Report prepared by O'Brien & Gere Engineers, Inc. were revised by Ebasco for quality changes provided by USEPA. No unit prices were changed.
2. The costs in this table were developed based upon the data currently available and several assumptions necessary to evaluate the alternatives. Because of the incomplete nature of this data and the possibility that actual conditions may vary considerably from these base assumptions, these costs are not necessarily indicative of the actual remediation costs that will be incurred. These costs should only be used for comparison of technical alternatives.
3. Line items provided to form budget cost only.

Table 14 — 6/24/93

NL Industries, Inc. Site

Soil Alternative E (500 ppm) - Cost Estimate (1,2)

EXCAVATION/ON-SITE SOLIDIFICATION/STABILIZATION OF HAZARDOUS SOILS/DISPOSAL

Item (3)	Quantity	Units	Unit Cost	Extended Cost	Total Cost
DIRECT CAPITAL COSTS					
Site Preparation					
Mobilization/Site Prep.	1.00	LS	$200,000.00	$200,000	
Road Relocation	1.00	LS	$35,000.00	$35,000	
Health and Safety Plan	1.00	LS	$20,000.00	$20,000	
Erosion/Sediment/Dust Control	1.00	LS	$50,000.00	$50,000	
Wooded Area Access	15.00	ACRE	$8,000.00	$120,000	
Treatability Testing	1.00	LS	$50,000.00	$50,000	
Subtotal					$475,000
Site Work					
Excavating/Load (On-Site)	28,000.00	CY	$15.00	$420,000	
Excavating/Load (Off-Site)	1,800.00	CY	$15.00	$27,000	
Sediments	8,300.00	CY			
Truck Haul	42,000.00	CY	$5.00	$210,000	
Confirmational Sampling	33.00	EA	$100.00	$3,300	
Subtotal					$660,300
On-Site Restoration					
Topsoil/Fill	22,000.00	CY	$20.00	$440,000	
Earthwork	27.00	ACRE	$5,000.00	$135,000	
Hydroseed	15.00	ACRE	$3,500.00	$52,500	
Wetlands Vegetation	12.00	ACRE	$15,000.00	$180,000	
Subtotal					$807,500
Off-Site Restoration					
Topsoil/Fill	2,450.00	CY	$20.00	$49,000	
Earthwork	3.00	ACRE	$5,000.00	$15,000	
Wetlands Vegetation	3.00	ACRE	$15,000.00	$45,000	
Subtotal					$109,000
On-Site Consolidation Pile					
Surface Prep/Cap Base Grading	7,400.00	CY	$5.00	$37,000	
Disposal Soil Grading (")	29,500.00	CY	$5.00	$147,500	
40 MIL VLDPE Geomembrane	79,000.00	SF	$1.00	$79,000	
Drainage Layer (6")	1,400.00	CY	$10.00	$14,000	
Root Zone Soil (24" Layer)	5,800.00	CY	$15.00	$87,000	
Topsoil 6"	1,400.00	CY	$20.00	$28,000	
Seed Fertilize & Mulch	1.80	ACRE	$5,000.00	$9,000	
Liner System	1.00	LS	$550,000.00	$550,000	
Subtotal					$951,500
Solidification/Disposal					
Soil Treatment	12,500.00	CY	$100.00	$1,250,000	
Haul Offsite, Treated Soil	18,750.00	CY	$50.00	$937,000	
Dispose Offsite, Treated Soil	18,750.00	CY	$100.00	$1,875,000	
Subtotal					$4,062,000
TOTAL DIRECT CAPITAL COSTS					**$7,065,300**
INDIRECT CAPITAL COSTS					
Contingency (25% +/-)				$1,766,300	
Engineering (15% +/-)				$1,060,000	
Administration (5% +/-)				$353,300	
Permitting				$100,000	
TOTAL INDIRECT CAPITAL COSTS					**$3,279,600**
TOTAL CAPITAL COSTS					**$10,344,900**
ANNUAL MAINTENANCE COSTS					
Cap Maintenance	1.00	LS	$5,000.00	$5,000	
TOTAL ANNUAL COSTS					**$5,000**
PRESENT WORTH (30 YR @ 5%)					**$77,000**
TOTAL ESTIMATED REMEDIAL COST					**$10,421,900**

Notes:

1. Cost estimates in Final Feasibility Study report prepared by O'Brien & Gere Engineers, Inc. were revised by Ebasco for quantity changes provided by USEPA. No unit prices were changed.

2. The costs in this table were developed based upon the data currently available and several and the possibility that actual conditions may vary considerably from these base assumptions, these costs are not necessarily indicative of the actual remediation costs that will be incurred. These costs should only be used for comparison of technical alternatives.

3. Line items provided to form budget cost only.

NL Industries, Inc. Site
Soil Alternative F (500 ppm) - Cost Estimate (1,2)
EXCAVATION/ON-SITE SOLIDIFICATION/STABILIZATION OF HAZARDOUS SOILS/CONSOLIDATION ON-SITE

Item (3)	Quantity	Units	Unit Cost	Extended Cost	Total Cost
DIRECT CAPITAL COSTS					
Site Preparation					
Mobilization/Site Prep.	1.00	LS	$200,000.00	$200,000	
Road Relocation	1.00	LS	$35,000.00	$35,000	
Health and Safety Plan	1.00	LS	$20,000.00	$20,000	
Erosion/Sediment/Dust Control	1.00	LS	$50,000.00	$50,000	
Wooded Area Access	15.00	ACRE	$8,000.00	$120,000	
Treatability Testing	1.00	LS	$50,000.00	$50,000	
Subtotal					$475,000
Site Work					
Excavating/Load (On-Site)	28,000.00	CY	$15.00	$420,000	
Excavating/Load (Off-Site)	1,800.00	CY	$15.00	$27,000	
Sediments	8,300.00	CY	-	-	
Truck Haul	42,000.00	CY	$5.00	$210,000	
Confirmational Sampling	33.00	EA	$100.00	$3,300	
Subtotal					$660,300
On-Site Restoration					
Topsoil/Fill	22,000.00	CY	$20.00	$440,000	
Earthwork	27.00	ACRE	$5,000.00	$135,000	
Hydroseed	15.00	ACRE	$3,500.00	$52,500	
Wetlands Vegetation	12.00	ACRE	$15,000.00	$180,000	
Subtotal					$807,500
Off-Site Restoration					
Topsoil/Fill	2,450.00	CY	$20.00	$49,000	
Earthwork	3.00	ACRE	$5,000.00	$15,000	
Wetlands Vegetation	3.00	ACRE	$15,000.00	$45,000	
Subtotal					$109,000
On-Site Consolidation Pile					
Surface Prep/Cap Base Grading	7,400.00	CY	$5.00	$37,000	
Disposal Soil Grading	29,500.00	CY	$5.00	$147,500	
40 mil VLDPE Geomembrane	79,000.00	SF	$1.00	$79,000	
Drainage Layer (6")	1,400.00	CY	$10.00	$14,000	
Root Zone Soil (24" Layer)	5,800.00	CY	$15.00	$87,000	
Topsoil (6" layer)	1,400.00	CY	$20.00	$28,000	
Seed, Fertilize, and Mulch	1.80	ACRE	$5,000.00	$9,000	
Liner System	1.00	LS	$550,000.00	$550,000	
Subtotal					$951,500
On-Site Solidification/Consolidation					
Soil Treatment	12,500.00	CY	$100.00	$1,250,000	
Haul On-Site	18,750.00	CY	$5.00	$93,750	
Subtotal					$1,343,750
TOTAL DIRECT CAPITAL COSTS					**$4,347,050**
INDIRECT CAPITAL COSTS					
Contingency (25% +/-)				$1,086,800	
Engineering (15% +/-)				$652,100	
Administration (5% +/-)				$217,400	
Permitting				$100,000	
TOTAL INDIRECT CAPITAL COSTS					**$2,056,300**
TOTAL CAPITAL COSTS					**$6,403,350**
ANNUAL MAINTENANCE COSTS					
Cap Maintenance	1.00	LS	$5,000.00	$5,000	
TOTAL ANNUAL COSTS					**$5,000**
PRESENT WORTH (30 YR @ 5%)					**$77,000**
TOTAL ESTIMATED REMEDIAL COST					**$6,480,350**

Notes:

1. Cost estimates in Final Feasibility Study Report prepared by O'Brien & Gere Engineers, Inc. were revised by Ebasco for quantity changes provided by USEPA. No unit prices were changed.
2. The costs in the table were developed based upon the data currently available and several assumptions necessary to evaluate the alternatives. Because of the incomplete nature of the data and the possibility that actual conditions may vary considerably from these base assumptions, these costs are not necessarily indicative of the actual remediation costs that will be incurred. These costs should only be used for comparison of technical alternatives.
3. Line items provided to form budget cost only.

NL Industries, Inc. Site
Soil Alternative G (500 ppm) - Cost Estimate (1,2)
EXCAVATION/OFF-SITE DISPOSAL

Item (3)	Quantity	Units	Unit Cost	Extended Cost	Total Cost
DIRECT CAPITAL COSTS					
Site Preparation					
Mobilization/Site Prep.	1.00	LS	$150,000.00	$150,000	
Health and Safety Plan	1.00	LS	$20,000.00	$20,000	
Erosion/Sediment/Dust Control	1.00	LS	$30,000.00	$30,000	
Wooded Area Access	15.00	ACRE	$8,000.00	$120,000	
Subtotal					$320,000
Site Work					
Excavating/Load (On-Site)	28,000.00	CY	$15.00	$420,000	
Excavating/Load (Off-Site)	1,800.00	CY	$15.00	$27,000	
Sediments	8,300.00	CY	-	-	
Haul Off-Site, Non-Haz. Waste	29,500.00	CY	$50.00	$1,475,000	
Dispose Off-Site Non-Haz. Waste	29,500.00	CY	$100.00	$2,950,000	
Haul Off-Site, Haz. Waste	12,500.00	CY	$50.00	$625,000	
Treat & Dispose Off-Site Non-Land Disposable Haz. Waste	6,250.00	CY	$385.00	$2,406,250	
Dispose Off-Site Land Disposable Haz. Waste	6,250.00	CY	$285.00	$1,781,250	
Confirmational Sampling	33.00	EA	$100.00	$3,300	
Subtotal					$9,687,800
On-Site Restoration					
Topsoil/Fill	22,000.00	CY	$20.00	$440,000	
Earthwork	27.00	ACRE	$5,000.00	$135,000	
Hydroseed	15.00	ACRE	$3,500.00	$52,500	
Wetlands Vegetation	12.00	ACRE	$15,000.00	$180,000	
Subtotal					$807,500
Off-Site Restoration					
Topsoil/Fill	2,450.00	CY	$20.00	$49,000	
Earthwork	3.00	ACRE	$5,000.00	$15,000	
Wetlands Vegetation	3.00	ACRE	$15,000.00	$45,000	
Subtotal					$109,000
TOTAL DIRECT CAPITAL COSTS					**$10,924,300**
INDIRECT CAPITAL COSTS					
Contingency (25% +/-)				$2,731,100	
Engineering (15% +/-)				$1,638,600	
Administration (5% +/-)				$546,200	
TOTAL INDIRECT CAPITAL COSTS					**$4,915,900**
TOTAL ESTIMATED REMEDIAL COST					**$15,840,200**

Notes:

1. Cost estimates in Final Feasibility Study Report prepared by O'Brien & Gere Engineers, Inc. were revised by Ebasco for quantity changes provided by USEPA. No unit prices were changed.

2. The costs in the table were developed based upon the data currently available and several assumptions necessary to evaluate the alternatives. Because of the incomplete nature of this data and the possibility that actual conditions may vary considerably from these base assumptions, these costs are not necessarily indicative of the actual remediation costs that will be incurred. These costs should only be used for comparison of techincal alternatives.

3. Line items provided to form budget cost only.

Table 27

NL Industries, Inc. Site

Sediment Alternative A - Cost Estimate (1,2)
NO ACTION

Item (3)	Quantity	Units	Unit Cost	Extended Cost	Total Cost
ANNUAL OPERATING AND MAINTENANCE COSTS					
Surface Water Monitoring Program					
Mobilization	1.00	LS	$500	$500	
Sampling Equipment	1.00	LS	$150	$150	
Sampler	24.00	Manhours	$50	$1,200	
Shipping	2.00	EA	$70	$140	
Analysis	10.00	Samples	$100	$1,000	
Analysis (QA/QC)	2.00	Samples	$100	$200	
Report	60.00	Manhours	$60	$3,600	
Subtotal (Semi-Annual Cost)				$6,790	
Annual Cost					$13,580
TOTAL ANNUAL O&M					**$13,580**
PRESENT WORTH (30 YR @ 5%)					**$209,000**
TOTAL ESTIMATED REMEDIAL COST					**$209,000**

Notes:

1. Cost estimate in Final Feasibility Study Report prepared by O'Brien & Gere Engineers, Inc. were revised by Ebasco for quantity changes provided. by EPA. No unit prices were changed.
2. The costs in this table were developed based upon the data currently available and several assumptions necessary to evaluate the alternatives. Because of the incomplete nature of this data and the possibility that actual conditions may vary considerably from these base assumptions, these costs are not necessarily indicative of the actual remediation costs that will be incurred. These costs should only be used for comparison of technical alternatives.
3. Line items provided to form budget estimate only.

Table 31

NL Industries, Inc. Site
Sediment Alternative B (500 ppm) - Cost Estimate (1,2)
SEDIMENT EXCAVATION/DREDGING

Item (3)	Quantity	Units	Unit Cost	Extended Cost	Total Cost
DIRECT CAPITAL COSTS					
Site Preparation					
Mobilization/Site Prep.	1.00	LS	$150,000.00	$150,000	
Health and Safety Plan	1.00	LS	$20,000.00	$20,000	
Erosion/Sediment Control	1.00	LS	$75,000.00	$75,000	
Clear and Grub Access	7.00	ACRE	$8,000.00	$56,000	
Subtotal					$301,000
East Stream					
Diversion					
Access Grading	9,000.00	SY	$2.00	$18,000	
Access Reinforcement	1,500.00	LF	$60.00	$90,000	
Diversion Excavation	1,200.00	CY	$10.00	$12,000.00	
Cofferdams	6.00	EA	$500.00	3,000.00	
Subtotal					$123,000
Sediment Removal (East Stream)					
Cement Solidification	400.00	CY	$25.00	$10,000.00	
Solidified Sediment Removal	800.00	CY	$50.00	$40,000.00	
Solidified Sediment Hauling	800.00	CY	$10.00	$8,000.00	
Confirmational Sampling	40.00	EA	$100.00	$4,000.00	
Subtotal					$62,000
Mechanical Dredging (North of US 130)					
Dredging	7,500.00	CY	$80.00	$600,000	
Dewatering	1.00	LS	$10,000.00	$10,000	
Subtotal					$610,000
Dredged Soil Disposal					
Loading	7,500.00	CY	$15.00	$112,500	
Haul to the Site Area	7,500.00	CY	$20.00	$150,000	
Confirmational Sampling	40.00	EA	$100.00	$4000.00	
Subtotal					$266,500
Restoration					
Stream FL Replacment Soil	1,900.00	CY	$15.00	$28,500	
Backfill Stream Flowline	1,900.00	CY	$5.00	$9,500	
Backfill Diversion	1,200.00	CY	$5.00	$6,000	
Vegetation	5.00	ACRE	$15,000.00	$75,000	
Subtotal					$119,000
TOTAL DIRECT CAPITAL COSTS					**$1,481,500**
INDIRECT CAPITAL COSTS					
Contingency (25% +/-)				$370,400	
Engineering (15% +/-)				$222,200	
Administration (5% +/-)				$74,100	
TOTAL INDIRECT CAPITAL COSTS					**$666,700**
TOTAL ESTIMATED REMEDIAL COST					**$2,148,200**

Notes:

1. Cost estimates in Final Feasibility Study Report prepared by O'Brien & Gere Engineers, Inc. were revised by Ebasco for quantity changes provided by EPA. No unit prices were changed.

2. The costs in the table were developed based upon the data currently available and several assumptions necessary to evaluate the alternatives. Because of the incomplete nature of this data and the possibility that actual conditions may vary considerably from these base assumptions, these costs are not necessarily indicative of the actual remediation costs that will be incurred. These costs should only be used for comparison of techincal alternatives.

3. Line items provided to form budget cost only.

EPA
NL INDUSTRIES INC

22-Jun-93
11:07 AM

BY:PJR 6/18/93
FILE:EPA_COMP COST COMPARISON

DESCRIPTION	UNIT	B UNIT PRICE	C UNIT PRICE	D UNIT PRICE	E UNIT PRICE	F UNIT PRICE	G1 UNIT PRICE	SED1 UNIT PRICE
TOTAL EST.REMEDIAL COST		22,161,600	13,383,300	10,712,400	10,422,400	6,480,200	15,840,200	2,142,400
SITE PREP								
MOBILIZATION/SITE PREP	LS	500,000	200,000	500,000	200,000	200,000	150,000	150,000
ROAD RELOCATION	LS	35,000	35,000	35,000	35,000	35,000	0	0
HEALTH & SAFETY PLAN	LS	20,000	20,000	20,000	20,000	20,000	20,000	20,000
EROSION/SEDIMENT/DUST CONTROL	LS	50,000	50,000	50,000	50,000	50,000	30,000	75,000
WOODED AREA ACCESS	ACRE	8,000	8,000	8,000	8,000	8,000	8,000	8,000
TREATABILY TESTING	LS	150,000	50,000	150,000	50,000	50,000	0	0
SITE WORK								
EXCAVATING/LOADING (ON-SITE) 8'+/-	CY	15.00	15.00	15.00	15.00	15.00	15.00	
EXCAVATING/LOADING (OFF-SITE) 5'+/-	CY	15.00	15.00	15.00	15.00	15.00	15.00	
SEDIMENTATION	CY							
TRUCK HAUL(SWELL FACTOR=10%)	CY	5.00	5.00	5.00	5.00	5.00		
HAUL OFF SITE NON HAZ WASTE		50.00		50.00	50.00		50.00	
HAUL OFF SITE HAZ WASTE							50.00	
DISPOSE OFF SITE NON HAZ WASTE		100.00		100.00	100.00		100.00	
DISPOSE OFF SITE LAND DISP HAZ WASTE							285.00	
TR,TODISP OFF SITE NON LAND DISP HAZ WASTE							385.00	
CONFIRMATIONAL SAMPLING	EA	100.00	100.00	100.00	100.00	100.00	100.00	100.00
ON-SITE RESTORATION								
TOPSOIL/FILL 6'±27 ACRES	CY	20.00	20.00	20.00	20.00	20.00	20.00	
EARTHWORK	ACRE	5,000	5,000	5,000	5,000	5,000	5,000	
HYDROSEED	ACRE	3,500	3,500	3,500	3,500	3,500	3,500	
WETLANDS VEGETATION	ACRE	15,000	15,000	15,000	15,000	15,000	15,000	15,000
OFF-SITE RESTORATION								
TOPSOIL/FILL 6'±3 ACRES	CY	20.00	20.00	20.00	20.00	20.00	20.00	
EARTHWORK	ACRE	5,000	5,000	5,000	5,000	5,000	5,000	
WETLANDS VEGETATION	ACRE	15,000	15,000	15,000	15,000	15,000	15,000	
ON SITE CONSOLIDATION PILE								
SURFACE PREP/CAP BASE GRADING	CY		5.00	5.00	5.00	5.00		
DISPOSAL SOIL GRADING (NOT TREATED)	CY		5.00	5.00	5.00	5.00		
40 MIL VLDPE GEOMEMBRANE	SF		1.00	1.00	1.00	1.00		
DRAINAGE LAYER (6')	CY		10.00	10.00	10.00	10.00		
ROOT ZONE SOIL (24'LAYER)	CY		15.00	15.00	15.00	15.00		
TOPSOIL 6'	CY		20.00	20.00	20.00	20.00		
SEED FERTILIZE & MULCH	ACRE		5000.00	5000.00	5000.00	5000.00		
LINER SYSTEM	LS		600,000	550,000	550,000	550,000		
SOIL WASHING/DISPOSAL								
SOIL WASHING	CY	200.00		200.00				
HAUL & BACKFILL W/CLEAN SOIL	CY	5.00		5.00				
SOLIDIFY FINES	CY	100.00		100.00				
BENCH SCALE TREATABILITY PROGRAM &	LS	100,000		100,000				

EPA
NL INDUSTRIES INC

22-Jun-93
11:07 AM

BY:PJH 6/18/93
FILE:EPA_COMP COST COMPARISON

DESCRIPTION	UNIT	B UNIT PRICE	C UNIT PRICE	D UNIT PRICE	E UNIT PRICE	F UNIT PRICE	G1 UNIT PRICE	SEDI UNIT PRICE
ON SITE PILOT DEMO.								
SOLIDIFICATION & DISPOSAL								
SOIL TREATMENT ON SITE			100.00		100.00	100.00		
HAUL TO SITE CONSOL.AREA			5.00			5.00		
EAST STREAM								
DIVERSION								
ACCESS GRADING	SY							2.00
ACCESS REINFORCEMENT.	LF							60.00
DIVERSION EXCAVATION	CY							10.00
COFFERDAMS	EA							500.00
SEDIMENT REMOVAL	CY							
CEMENT SOLIDIFICATION	CY							25.00
SOLIFIED SEDIMENT REMOVAL	CY							50.00
SOLIFIED SEDIMENT HAULING ON SITE	EA							10.00
RESTORATION								
STREAM F L REPLACEMENT SOIL	CY							15.00
BACKFILL STREAM FLOWLINE	CY							5.00
BACKFILL DIVERSION	CY							5.00
VEGETATION	ACRE							15.000
NORTH OF RTE 130								
MECHANICAL DREDGING	CY							10.00
DEWATERING	LS							10.000
DREDGE SOIL DISPOSAL								
LOADING	CY							15.00
HAUL TO ON SITE AREA	CY							20.00

ATTACHMENT B
SUMMARY RISK TABLES (EXCLUDING LEAD)

NL INDUSTRIES SITE
OPERABLE UNIT ONE
PEDRICKTOWN, NEW JERSEY

JULY 1993

NL Industries: Risk Summary Tables

Carcinogenic Risk

P A T H W A Y

Receptor		Soil Ingestion	Soil Dermal	Air (Inhal.)	Ground Water Ingestion	Ground Water Dermal	Ground Water Inhalation
Future							
Off-site	Ca	8E-7	9E-8		**5E-4**	9E-6	**3E-4**
Child	HI	2.4E-3	4.1E-3		**15.78**	0.35	0.09
Off-site	Ca	1E-6	2E-7		**2E-3**	8E-5	**1E-3**
Adult	HI	2E-3	2E-3		**11**	4E-1	**1.0**
Off-site	Ca	9E-7	2E-7		**9E-4**		
Worker	HI	2E-3	4E-3		**3.81**		
On-site	Ca	9E-6	2E-6	7E-6	**1E-3**	2E-5	**6E-4**
Child	HI	**1.3**	**4.7**		**17.32**	0.49	0.10
On-site	Ca	2E-6	3E-7	5E-6	**2E-3**	8E-5	**1E-3**
Adult	HI	0.05	0.16		**10.0**	0.40	0.50
On-site	Ca	2E-6	3E-7	3E-6			
Worker	HI	0.05	0.16				

*A blank box indicates that this exposure pathway was not complete, and therefore, not calculated.

NL Industries: Risk Summary Tables

Carcinogenic Risk

P A T H W A Y

Receptor		Soil Ingestion	Soil Dermal	Air (Inhal.)	Ground Water Ingestion	Ground Water Dermal	Ground Water Inhalation
Current							
Off-site	Ca	3E-8	3E-9				
Child	HI	2.4E-3	4.1E-3				
Off-site	Ca	1E-6	2E-7				
Adult	HI	2E-3	2E-3				
Off-site	Ca	9E-7	2E-7				
Worker	HI	1.7E-3	3.6E-3				

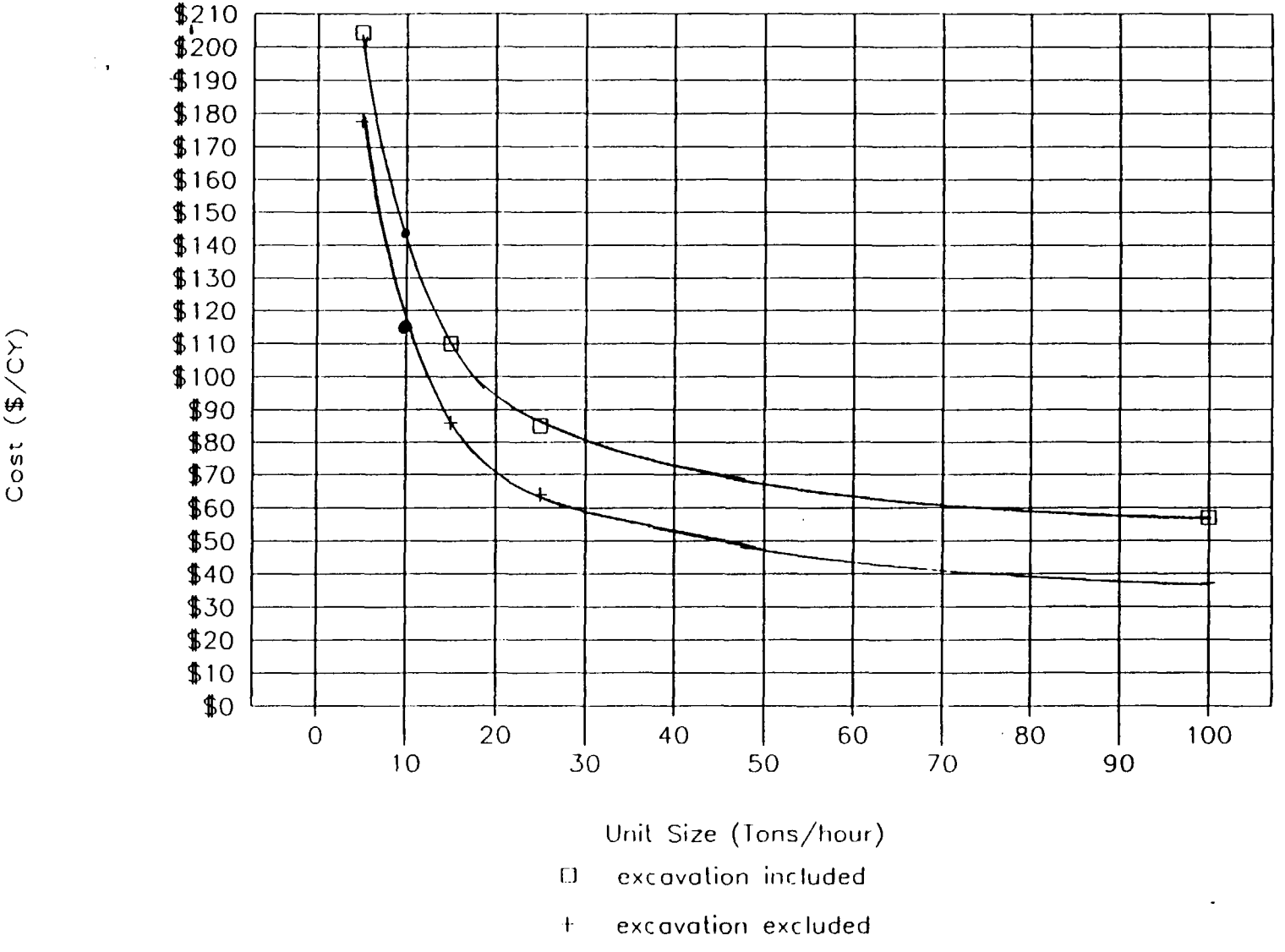
ATTACHMENT C
SOIL WASHING COST PER CUBIC YARD

NL INDUSTRIES SITE
OPERABLE UNIT ONE
PEDRICKTOWN, NEW JERSEY

JULY 1993

Fig. 1 Soil Washing Costs per CY

Vendor Supplied Data



ATTACHMENT D
CHEMICAL SPECIFIC STREAM DISCHARGE CRITERIA

NL INDUSTRIES SITE
OPERABLE UNIT ONE
PEDRICKTOWN, NEW JERSEY

JULY 1993

CHEMICAL-SPECIFIC STREAM DISCHARGE CRITERIA

Compound	Maximum Conc. Detected in Ground Water (µg/l)	Freshwater Stream Discharge Class FW-2[b] (µg/l)			
		Criterion Maximum Conc.[f]	Criterion Contin. Conc.[g]	1E-06 Human Health Risk: Organisms & Water	1E-06 Human Health Risk: Organisms Only
Volatile Organics					
Acetone	14				
Bis(2-ethylhexyl)phthalate	13			1.8[a,c]	5.9[a,c]
Chloroform	7			5.7[a,c]	470[a,c]
1,2-Dibromomethane	2				
1,1-Dichloroethane	74				
1,1-Dichloroethene	210			0.057[a,c]	3.2[a,c]
1,2-Dichloropropane	0.5				
Ethylbenzene	0.6			3,100[a,c]	29,000[a,c]
Naphthalene	2.3	2,300	620		
N-Nitroso-di-n-propylamine	11				
Tetrachloroethene	210			0.8[c]	8.85[c]
Toluene	1.8			6,800[a]	200,000[a,c]
1,1,1-Trichloroethane	4,700			3,100[p]	170,000[p]
1,3,5-Trimethylbenzene	0.8				
1,2,4-Trimethylebenzne	2.7				
Vinyl chloride	76			2[c]	525[c]
Xylenes (total)	5.6			10,000[q]	

CHEMICAL-SPECIFIC STREAM DISCHARGE CRITERIA

Compound	Maximum Conc. Detected in Ground Water (µg/l)	Freshwater Stream Discharge Class FW-2[b] (µg/l)			
		Criterion Maximum Conc.[f]	Criterion Contin. Conc.[g]	1E-06 Human Health Risk: Organisms & Water	1E-06 Human Health Risk: Organisms Only
Inorganic Compounds					
Antimony	122			14[a]	4300[a]
Arsenic	18,200	360[m]	190[m]	0.18[abc]	0.14[abc]
Beryllium	156			.0076[p]	0.131[p]
Cadmium	1,010	3.9[e,m]	1.1	n	n
Chloride	150,000				
Chromium	14,340	16[e,m]	11[e,m]	n	n
Copper	14,680	18[e,m]	12[e,m]		
Lead	6,290	82[e,m]	3.2[e,m]	50	
Mercury	0.6	2.4[m]	0.12[m]	0.14	
Nickel	2,480	1,400[e,m]	160[e,m]	610	
Silver	37	4.1[e,m]			
Sulfate	25x10[6]	250,000[o]	250,000[o]		
Thallium	3			1.7[a]	6.3[a]
Zinc	9,690	120[e,m]	110[e,m]	—	

Note:

The following conventional parameter limits must also be considered:

Parameter	Maximum Detected In Ground Water	Maximum Detected In Surface Water	Limit	Rationale
BOD	—	—	25 ppm	NJAC 7:9-5.1.
COD	—	—	31 ppm	Assume BOD:COD ratio is 0.8.
TDS	—	—	95 ppm	133% of natural background concentration. NJAC 7:9-4.
pH	—	—	6.5-8.5	NJAC 7:9-4.
TSS	—	—	40 ppm	NJAC 7:9-4.
Whole effluent toxicity	—	—	L_c = 100	No observed effects using 100% effluent. NJAC 7:9-4.

Treatability testing will determine the ability of a treatment system to meet these limits.

From the Federal Register/ Vol. 57, No. 246/ December 22, 1992/ 60912-60922

[a] Criteria revised to reflect current agency RfD, as contained in IRIS.

[b]The criteria refers to the inorganic form only.

[c]Criteria matrix based upon carcinogenaity of (10 E-06).

[e]Freshwater aquatic criteria expressed as a function of total hardness. Assumes hardness of 100 (mg/l) and water effects ration of 1.0.

[m]Criteria expressed as a function of the water effects ratio as defined in 40 CFR 131.36(c).

[n]EPA is not promulgating human health criteria for this contaminant. Permit authorities should address this contaminant in NJPDES permit.

[o]New Jersey Water Quality Standards NJAC 7:9-4.1.

[p]Federal Ambient Water Quality Criteria.

[q]Federal Maximum Contaminant Level.

— Value not available.

ND = Not Detected

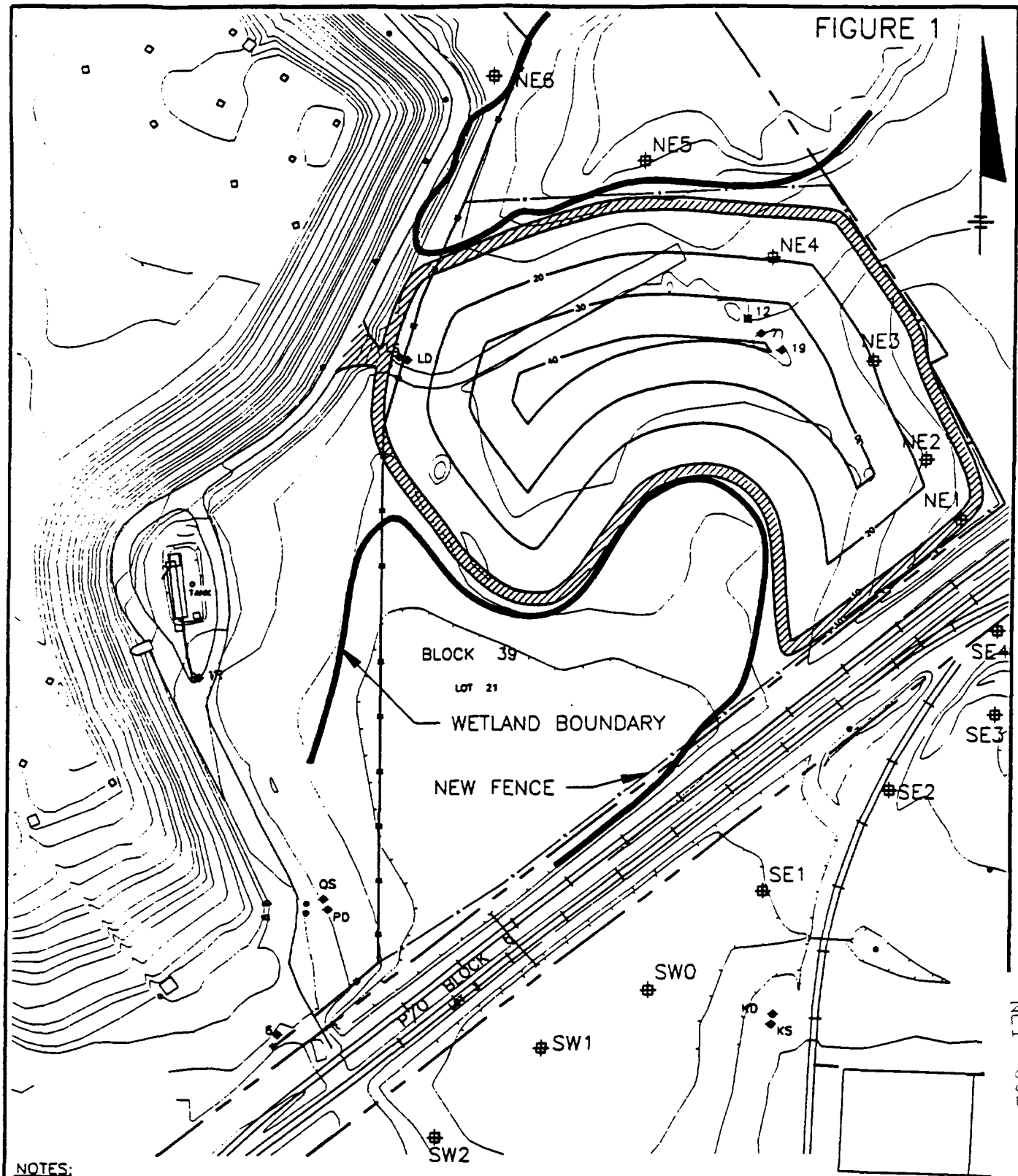
ATTACHMENT E
POTENTIAL LANDFILL CONFIGURATIONS

NL INDUSTRIES SITE
OPERABLE UNIT ONE
PEDRICKTOWN, NEW JERSEY

JULY 1993

PRELIMINARY

FIGURE 1



NOTES:

1. TOTAL FOOTPRINT=85,000 SQ. FT. (2 ACRES)

PROPOSED CONSOLIDATION PILE (APP. 30,000 CUBIC YARD CAPACITY)

NL INDUSTRIES, INC. SITE

100 0 100

1"=100'

FILE No. 2844.014.714

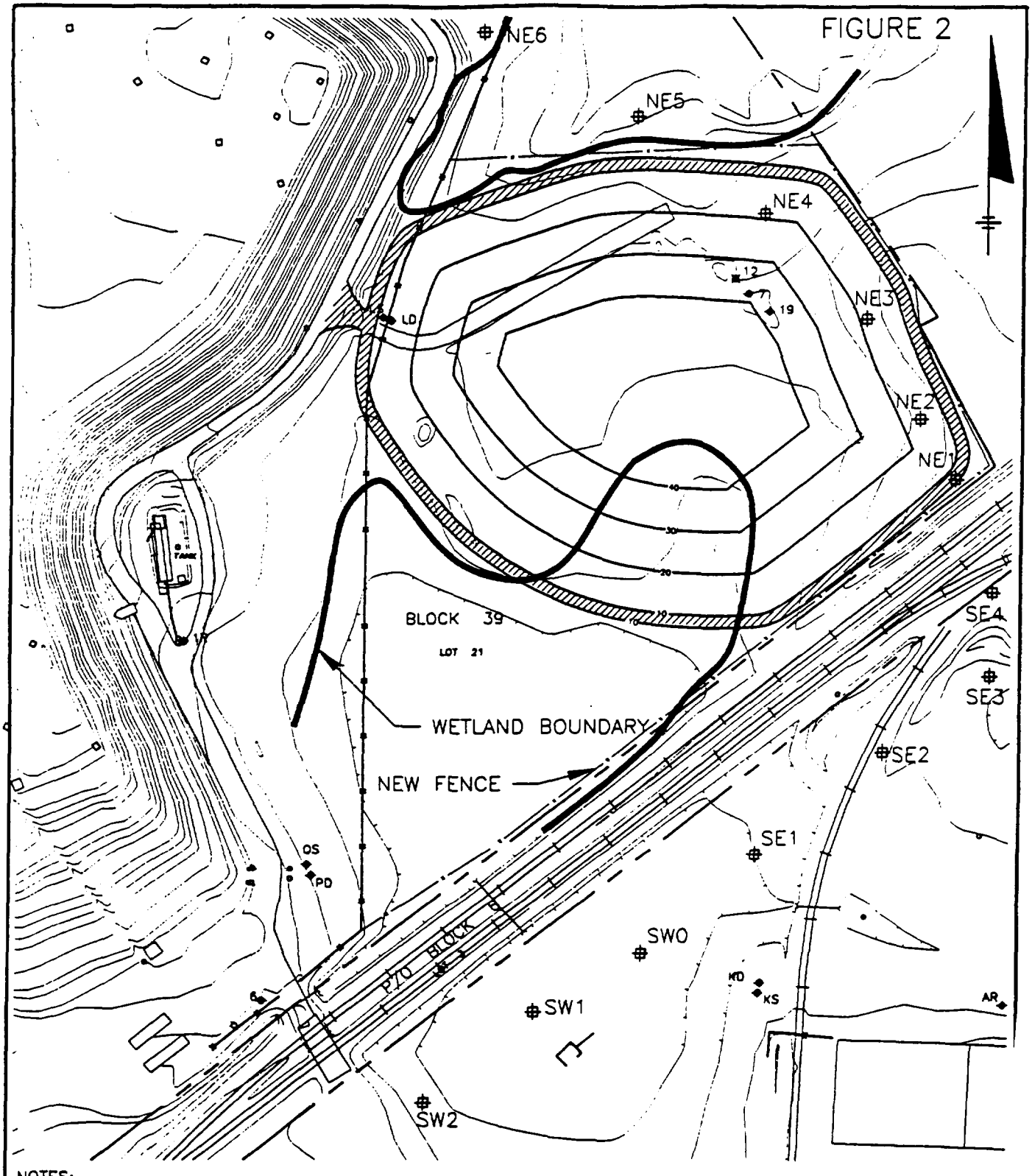
284449-100

NLI 002 0424

OSED

PRELIMINARY

FIGURE 2



NOTES:

1. TOTAL FOOTPRINT=101,000 SQ. FT. (2.37 ACRES)
2. WETLAND ENCROACHMENT=12,300 SQ. FT. (.28 ACRES)

PROPOSED CONSOLIDATION PILE (APP. 54,000 CUBIC YARD CAPACITY)

NL INDUSTRIES, INC. SITE

100 0 100

1" = 100'

FILE No. 2844.014.714

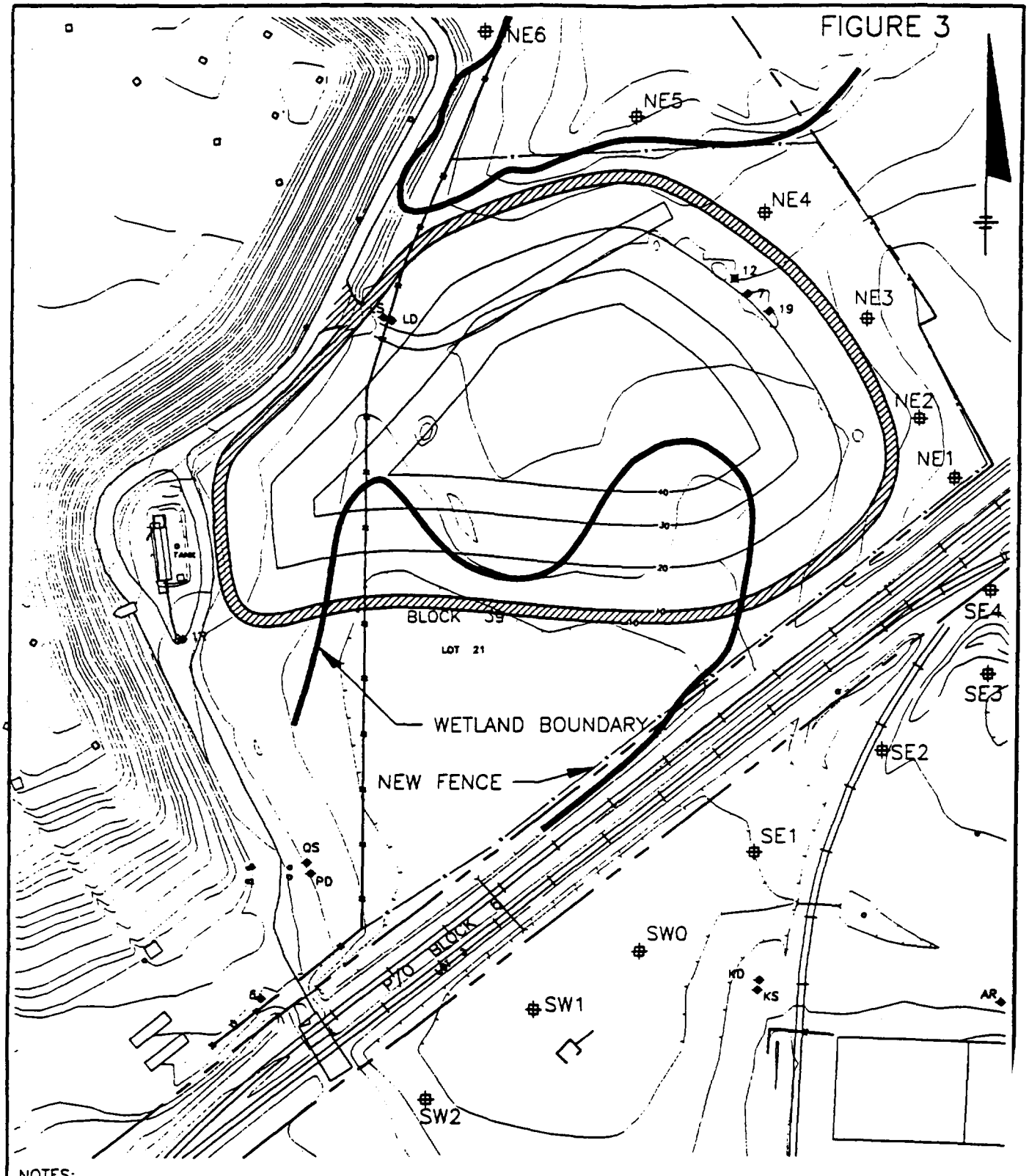
284448-100

NLI 002 0425

DESC

PRELIMINARY

FIGURE 3



NOTES:

1. TOTAL FOOTPRINT=105,000 SQ. FT. (2.41 ACRES)
2. WETLAND ENCROACHMENT=14,000 SQ. FT. (.32 ACRES)

PROPOSED CONSOLIDATION PILE (APP. 48,000 CUBIC YARD CAPACITY)

NL INDUSTRIES, INC. SITE

100 0 100

1" =100'

FILE No. 2844.014.714

O'BRIEN & GERE

284450-100

NL I 002 0426

DESC

ATTACHMENT F
GROUND WATER ARARS

NL INDUSTRIES SITE
OPERABLE UNIT ONE
PEDRICKTOWN, NEW JERSEY

JULY 1993

NL INDUSTRIES SITE
GROUND WATER ARARS
(ppb)

HAZARDOUS CONTAMINANT	NJGWQS[1]	PQL[2]	MCL[3]
Acetone	700	NA	-
Bis-(2-ethylhexyl)phthalate	3	30	-
Chloroform	6	1	-
1,2-Dibromomethane	-	-	-
1,1-Dichloroethane	70	-	-
1,1-Dichloroethylene	1	2	7
1,2-Dichloropropane	0.5	1	5
Ethylbenzene	700	5	700
Naphthalene	-	-	-
N-Nitroso-di-n-propylamine	0.005	20	-
Tetrachloroethylene	0.4	1	5
Toluene	1,000	5	1,000
1,1,1-Trichloroethane	30	1	200
1,2,4-Trimethylbenzene	-	-	-
1,3,5-Trimethylbenzene	-	-	-
Vinyl Chloride	0.08	5	2
Xylene(s) (total)	40	2	10,000
o-	NA	1	-
m&p-	NA	2	-
METALS (ppm)			
Antimony	2	20	6
Arsenic (total)	0.02	8	50
Beryllium	0.008	20	4
Cadmium	4	2	5
Chromium (total)	100	10	100
Copper	1,000	1,000	-
Cyanide	200	40	200
Lead (total)	5	10	-
Mercury (total)	2	0.5	2
Nickel (soluble salts)	100	10	100
Selenium (total)	50	10	50
Silver	NA	2	-
Thallium	0.5	10	2
Zinc	5,000	30	-

[1]New Jersey Ground Water Quality Standards (NJGWQS) (N.J.A.C. 7:9-6) are expressed in parts per billion (ppb).

[2] The Practical Quantitation Levels (PQLs) are expressed in ppb. In accordance with N.J.A.C. 7:9-6.9(c), where a constituent standard (the criterion adjusted by the antidegredation policy and applicable criteria exemptions) is of a lower concentration than the relevant PQL, The Department shall not (in the context of an applicable regulatory program) consider the discharge to be causing a contravention of that constituent standard so long as the concentration of the constituent in the affected ground water is less than the relevant PQL.

[3]Federal Maximum Contaminant Levels (MCLs) are expressed in ppb. For any listed contaminant, the more stringent of the federal MCL and the NJGWQS applies.